RURAL STATE AND PROVINCE SERIES

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RURAL TEXAS

RURAL STATE AND PROVINCE SERIES

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PLATE I. A section of a hard-surfaced road in Texas. Hundreds of miles of highways similar to this have been built or are in course of construction in the State.

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RURAL TEXAS

BY

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New York

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PREFACE

THE contents of this volume are devoted to an analysis of the agricultural resources and rural life conditions in Texas. Some consideration has also been given to the physical basis and the historical setting as a background. But this book is not intended to be a history of rural life in Texas; neither is it intended to present in detail the geological and physiographical basis of Texas agriculture. However, it has seemed desirable to record those facts of history and to call attention to the geological formations and physiographical facts that have directly influenced rural life and welfare.

It has not been an easy task to appraise the agricultural resources and rural life conditions in Texas. The writer has lived all his life in this State and in intimate contact with rural life conditions. There is no part of the State with which he is not reasonably familiar. But the vast area of the State and the great differences in topography and climate, with the resultant extent and variety of agricultural products, have made it difficult to present adequately and with relative importance the aspects of the subject. It will be obvious to those familiar with the agricultural resources of Texas that much more could have been written about this or that product. But the limita-

tion of space made it necessary to condense many topics and actually to omit the discussion of some that would have added to the completeness of the volume.

The preparation of this volume has repeatedly reminded the author that there is an inviting field for the competent historian to write a history of Texas agriculture. The material is abundant, but much of it is inaccessible. Some of this material is of great value and definite steps should be made to preserve and utilize it. The sources of political history of Texas have been collected and much of it used in the preparation of several popular histories of the State, but little effort has been made to perform a similar task for those sources of materials so vitally related to the industry that has given the State preëminence in the nation.

The writer is greatly indebted to many persons for assistance in the preparation of this volume. Public officials, associates in the Agricultural and Mechanical College of Texas, including county home and farm demonstration agents, editors of the daily and agricultural press and others, have supplied information, photographs, maps and other material for this volume. Special acknowledgment is due Mr. W. T. Carter, of the Division of Soil Surveys of the Texas Agricultural Experiment Station, for assistance in preparing the chapter on soils. To all those who have so readily responded to his requests for material and information, the author renders grateful acknowledgment.

The writer has found the task of preparing this volume an agreeable one. It has given him a more adequate appreciation of the agricultural resources of his State and increased his faith in the great possibilities of its agricultural development. If this book accomplishes a similar purpose for others interested in the rural welfare of Texas, he will feel amply repaid for the time and effort consumed in the preparation of this volume.

W. B. B.

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RURAL TEXAS

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CHAPTER I

THE PHYSICAL AND CLIMATIC SETTING OF TEXAS

The geographical location of Texas, the diversity of its surface features, and the variety of its climate are important considerations to an adequate understanding of the productive resources of the State. An attempt, therefore, will be made to present these characteristics before undertaking a discussion of the natural and agricultural resources of the State.

Texas is located in the southwestern part of the United States and in the census classification is designated as one of the states in the West South Central Division. The natural and surveyed boundaries are as follows: beginning with the Sabine Lake on the southeast the State line follows the course of the Sabine River north to the thirty-second parallel. Thence the boundary runs due north to the Red River. This river forms the northern boundary until the hundredth meridian is reached. From this point the boundary runs north to 36° 30′, from whence the line runs due west to the hundred and third meridian. The boundary between Texas and New Mexico ex-

tends from this point south to the thirty-second parallel. The boundary of the State follows this line west to the Rio Grande. This river and the Gulf of Mexico form the southwestern and southern boundaries of Texas.

It is well known that Texas is the largest state in the Union. The total area is 265,780 square miles. Approximately 3,490 square miles are covered with water and 262,290 square miles constitute the land surface.

Comparatively, Texas constitutes between one-eleventh and one-twelfth of the total area of the United States, exclusive of Alaska and the Philippine Islands. The area of the State exceeds the combined areas of North Carolina, South Carolina, Georgia, Alabama, and Florida by approximately 12,500 square miles. The area of Texas exceeds that of France by 61,633 square miles, and that of Germany by 57,037 square miles.

The distance across the State from the point of intersection of the thirty-second parallel with the Rio Grande on the west to the point of intersection of the thirty-first parallel with the Sabine River on the east is approximately 770 miles. It is about the same distance from the mid-point of the northern boundary of the Panhandle to the mouth of the Rio Grande.

GENERAL SURFACE FEATURES

The surface features of Texas are very diverse. Gentle slopes, undulating plains, hills, mountains,

plateaus and valleys are all to be found within the State. The Coastal region is characterized by the Gulf slope. This region lies to the south and east of the Central Basin and the Edwards Plateau. There are four or more less clearly differentiated areas within the Gulf Coast slope. They are designated as follows:

1. The Coastal Plain is a flat treeless region lying along the Gulf. It varies in width from thirty miles on the Sabine to more than a hundred miles on the west in the region of the Brazos and Colorado rivers. In elevation it rises approximately twenty or thirty feet above sea level on its outer margin. The elevation towards the interior increases quite gradually. The Coastal Plain has a very low altitude, and is very nearly flat. It slopes from the interior to the Gulf at an average rate of about one foot to the mile. The Coastal Plain gradually merges with the Rio Grande Plain west of the Colorado River.

2. The Rio Grande Plain lies between the Gulf and the Balcones Scarp on the north. It merges into the Coastal Plain in the valley of the Colorado River and the boundary between the two is not very definitely marked. The chief distinction between these two plains is traceable to the geological formations that underlie them. The Coastal Plain is built upon the Recent and Neocene rocks, while the Rio Grande Plain is underlaid not only by these but by geological formations of an earlier period. The Rio Grande Plain merges into the Coastal Plain, the forested area and the Black Land Prairie region on the north and

northeast. Here, too, the differentiating characteristic is that of the geological formation.

The shore line of the Gulf coast is broken by deltas, peninsulas and islands. The delta at the mouth of the Trinity River, the Matagorda peninsula, and the Padre islands are typical of these formations along the Gulf coast. The silt deposit from the larger rivers is continually extending the Coastal Plain seaward. This process, however, is being opposed continually by prevailing winds, waves, and tides. The conflict between the flood waters from the rivers and winds, waves and tides from the sea has resulted in the formation of numerous lagoons and bays along the Gulf coast. The amount of silt brought down to the mouth of the rivers and deposited is so great that the river approaches have become obstructed by bars that greatly reduce the number of good harbors along this coast.

3. The forested area is confined to east Texas. The country is somewhat rugged and the surface is covered with a forest growth. In the interior of the section the erosion of the streams has produced broad deep valleys. The hills are usually flat-topped and reveal outcroppings of sandstone rock, and in some cases iron ore. Some of these hills reach a height of 700 feet, but the average height above sea level is probably not more than half of that elevation. Toward the west the forest growth becomes less diverse and increasingly scant.

4. The Central Prairie region comprises the Black and Grand Prairie sections of the State. It

lies between the forested area on the east and the Central Basin on the west. The Black and Grand prairie region is differentiated by geological formations rather than by distinctive surface characteristics. The geological formation of this region reveals successive outcroppings of cretaceous strata. The Eastern Cross timbers also intersect this section of the State.

The surface of the Black Prairies may be described as undulating plains cut by small streams, fringed with trees and undergrowth. The black soil is deep and very fertile. The cities of Waco and Dallas are well within the central area of this important region.

The Grand Prairie lies to the west of the Black Prairie and resembles it in many respects. The Grand Prairie, however, is more nearly treeless than the Black Prairie, as many clumps of live oak and other forest growths are found in the Black Prairie, while practically no forest trees are native in the Grand Prairie area. Geologically the Black Prairie differs from the Grand Prairie in that the former is underlaid by successive outcroppings of cretaceous strata while the latter is underlaid by limestone.

5. The Central Basin region lies in the north central part of the State between the Gulf slope region on the east and the Great Plateau region on the west and northwest. It is divided into a north and south section by a hilly watershed between the sources of the Brazos and Colorado rivers that has been called "Callahan Divide."[1] The characteristics of the

[1] See Simonds' *Geography of Texas*, p. 21.

two areas are quite different. Within the northern region the surface presents the appearance of a rolling plain. In the southern part of the basin the relief is quite marked and the rugged hills are often called mountains. Within this area are the granite hills of Burnet and Llano counties.

6. The Plateau region comprises most of central west Texas. It is clearly separated from all other sections by definite demarkations. On the east it is divided from the Central Basin by eastward-facing escarpments. The Balcones scarp, which is the dislocation of underlying rock, for a long distance separates it from the Rio Grande plain on the south. It is bound on the southwest by the Rio Grande and the Trans-Pecos Mountains. There are three well-known divisions of this region known as (1) the Stockton Plateau, (2) the Edwards Plateau, (3) the Staked Plains, or the Llano Estacado.

The Stockton Plateau is located between the Pecos River and the Trans-Pecos Mountains. This is the smallest of the three plateau regions in the western part of Texas.

The Edwards Plateau is separated from the Grand Prairie of the central area of the State by the valley of the Colorado River and its principal tributaries. The eastern and southern margins of the plateau are fringed with hills almost towering into mountains in some sections, notably in the region west of Austin. From an elevation of approximately 1,000 feet in this section the plateau rises gradually toward the northward where it merges into the Staked Plains.

The Staked Plains or the Llano Estacado is a level tractless region in the extreme western and northwestern part of Texas. The Red, Brazos, and Colorado rivers have their sources in the eastern part of this plateau and have cut deep canyons for considerable distances on the eastern margin of this elevated plain. From this scarp on the east this plateau gradually rises to an elevation of 4,000 feet in the northeastern part of the Panhandle of northwest Texas.

7. The mountains of Texas are a part of the Western Cordillera which extends from Alaska to the extreme southern part of South America. These mountain elevations are between the Rio Grande and the Pecos River. They include the Guadalupe, Davis, Ord, Santiago, Corazones, Rosillos, and Chisos mountains. They range in elevation from 1500 feet in the valley of the Rio Grande at the eastern base of Sierra del Carmen to 8,690 feet in El Capitan, a peak of the Guadalupe range near the New Mexico boundary. The highest peak of the Davis Mountains is Mount Livermore, which is 8382 feet. The highest peak of the Chisos Mountains is Mount Emory which is approximately 9,000 feet. The Davis, Corazones and Chisos are of volcanic origin. The Guadalupe Mountains are composed principally of Permian rocks.

Another elevation of mountains enters the State at the New Mexico border and parallels the Rio Grande nearly to the Big Bend section. The mountains, named in order from northwest to southeast,

are the Hueco, Finley, Quitman, Eagle, and Viega. Granite and other forms of igneous rock are in these mountains. Both carboniferous and cretaceous limestone are also to be found.

8. The surface appearance of the Trans-Pecos region of Texas is one of contrasts. The flat-topped mountains rise out of the sandy plains, sometimes in groups and sometimes as sharp single mountainous elevations. The plateau elevations that separate the mountains differ from ordinary plateaus in that the surface is not composed of hard layers but is usually the product of silt brought down by erosion from the mountain slopes. Between these mountains and plains deep ravines have been cut by erosion.

The interior basin between the Delaware Mountains and the Sierra Diablo is salt. The interior drainage of the basin is collected in a number of salt lakes.

STRUCTURAL GEOLOGY

The several rock formations in Texas outcrop, for the most part, in a series of more or less parallel strips, extending in a northeast and southwest direction across the State. Beginning with the latest formed marine rock bordering on the Gulf Coast are successive formations in regular order from the Coast to the interior. Each successive formation is of greater age than the preceding one until the Staked Plains are reached in the northwest part of the State, the only exception being the outcropping of igneous

rock in the so-called Central Mineral region comprising a large part of Llano and Mason counties.

The geological formation indicates that the area comprising the State of Texas has been completely or partially submerged several times since the first sedimentary rock was deposited by the subsiding sea. As a result of these successive submergences, sediments of great thickness were deposited. The successive submergences that followed the deposit of sediment eroded and removed much of the sedimentary bed. The effect of these changes has been that no one of these sedimentary formations extends over the entire State. These processes also explain the fact that limestone, clay, shale, and sandstone, extending to great depths, are found to compose most of the land area of Texas.

The exposure of igneous rock is relatively small in Texas. Rocks of this character are unknown except in two rather widely separated regions. One of these is the mountainous section west of the Pecos River; the other comprises the "Burnet country" in the central portion of the State. It is estimated by J. A. Udden that igneous rock probably covers not more than 6,500 square miles or 2.4 percent of the surface of the State, while sedimentary rock covers approximately 97.6 percent of the surface. Sedimentary rock underlies this vast area to depths of several thousand feet.[1]

[1] See Bull. No. 44 (1916) of the Univ. of Texas, pp. 28 and 29. The writer has drawn liberally for all the material on the geology of Texas from the writings of Dr.

The following tabulation gives the names and indicates the ages of the larger divisions of sedimentary rocks that have been identified in Texas:

Cenozoic	Quaternary	Recent Pleistocene
	Tertiary	Pliocene Miocene Oligocene (?) Eocene
Mesozoic	Cretaceous	Upper Cretaceous Comanchean
	Jurassic	
	Triassic	
Paleozoic	Anthracolitic	Permian Pennsylvanian Mississippian (?)
	Devonian (?)	
	Silurian	
	Ordovician	
	Cambrian	

Archeozoic: Pre-Cambrian

The latest formations are found to overlie the older rocks almost everywhere. The latest deposits are near the Gulf Coast. Formations of earlier age are found in succession toward the interior of the State until the "Burnet country" is reached. Here are rocks of the earliest geological period. From this

Robert T. Hill and Dr. J. A. Udden, contained in bulletins on the geology of Texas.

relatively small area northwestward are rock formations of more recent times. On the high plains in the northwestern part of the State recent deposits overlie the older ones throughout this section. In the broken regions west of the Pecos River all the formations outcrop from the earliest to the latest and often these appear within very short distances of each other.

Pleistocene and recent formations extend along the Gulf Coast from a few feet to approximately 1,600 feet. Littoral sediments composed of sands, gravels, clays, and mixtures of these materials extend inland from fifty to ninety miles of the Gulf. In these deposits are to be found shells, trunks and limbs of trees, and bones of animals, including those of the horse, bison, and deer.

The Tertiary formations in Texas underlie the Pleistocene of the Gulf Coast and extend in a belt diagonally across the State from Louisiana to Mexico. This belt is approximately 180 miles wide in the eastern part of the State. It gradually narrows down toward the central area, being only approximately seventy miles wide between the San Antonio and the Colorado river basins. From that area it widens toward the west where it attains a width of approximately 120 miles on the Rio Grande. The youngest formations of the Tertiary outcrop nearest the Gulf of Mexico and the oldest formations appear farthest inland.

The Miocene and Pliocene underlie the Pleistocene and consist of deposits resembling it. However, in

the areas of outcrop the deposits contain fossils of non-marine origin, including those of land vertebrates. When these formations are penetrated by deep drillings near the present Gulf shore, marine fossils are frequently found. The clay of this formation is grayish, yellowish-green, pink, or brown in color. What is known as the Fleming clay of this formation is from 200 to 400 feet thick. This is called "gumbo" by oil drillers. Some of the sand is rather coarse, while other sand is fine in texture. Some of the deep wells along the Coast penetrating this stratum produce brackish water.

The oldest formation of the middle Tertiary is the Oligocene, which is described as the Corrigan or Catahaula sandstone. It is only known in east Texas where its outcroppings appear in Newton, Jasper, Angelina, Tyler, Polk, Trinity, San Jacinto, Walker, Grimes, and Brazos counties. Its thickness ranges from 250 to approximately 600 feet. The coarseness of this sand has caused it to be called "rice sand." However, it is not uniform in texture. The coarse sands are found near the base. The upper sands are finer and contain some clay.

The lower Tertiary or Eocene occurs in the interior of the State on the inner Coastal Plain. Seven formations of this stratum have been described by geologists.

Under the Corrigan or Catahaula is the Jackson formation which consists of some 250 feet, or less, of marly clay. It is differentiated by the large Calcarious Concretions, known as "bowlders", found in

it, and also by the presence of angular particles of volcanic dust. Its outcroppings appear in Sabine, San Augustine, and Angelina counties.

Below the Jackson formation is the Yegua clay which is grayish-green and dark gray. It contains lignite in some localities in east Texas. It outcrops in more than twenty counties as widely separated as Sabine, Burleson, and McMullen. In regular order the Yegua is underlaid by the Cook Mountains, Mount Selman, Wilcox, and Midway formations. All of these are more or less alike. The Wilcox formation of the Eocene is the thickest of all, being from 860 to 1200 feet thick in east Texas. Outcroppings of all these formations appear widely distributed in many counties of the State.

The upper Cretaceous comprises the strata below the Tertiary and above the Comanchean. This formation is generally regarded as the most important in Texas because of its wide distribution and the economic value of this rock.[1]

The upper Cretaceous formations are composed of clay, shale or marl, chalky flags, and sandstone. They outcrop over a large area from thirty to seventy-five miles wide extending from the northeast corner of the State diagonally southwest to San Antonio and thence west to Del Rio. The thickness of the two series of rocks comprising the Cretaceous system is approximately 5,000 feet.

[1] See Robert T. Hills' "A Brief Description of the Cretaceous Rocks of Texas", first annual report of the Geological Survey of Texas, 1889.

The upper Cretaceous of Texas includes, from above downward, the Escondido beds, Navarro beds, Taylor marl, Austin chalk, Eagle Ford shales, and the Woodbine formations. These several formations appear in two characteristic geographic areas in northeast and central Texas and in the Trans-Pecos region. In these two areas there are some important differences in the characteristics of the several formations. For example, in the northeastern part of the State the Eagle and Ford formation is composed of blue and black laminated bituminous clays, while in the Big Bend country of the Trans-Pecos region the Eagle and Ford shales consist of a limestone in flaggy beds which contain a slight admixture of fine siliceous sand and clay.

The stratum known as the Comanchean (lower Cretaceous) lies just below the upper Cretaceous and is essentially of limestone formation with some marly clay and sandstone. This rock formation extends over a large area in Texas. It covers a belt of country extending from Gainesville, in Cook County, in the northern part of the State almost to San Antonio, and from that section west over the entire Edwards Plateau. Its greatest known thickness in Texas is 1,500 feet in the Big Bend country of the Rio Grande. The most important deposit of the Comanchean formation is the sand which has been described as "yellowish sand, varying from packsand to gravel". This is the well known Trinity sand which is the great water-bearing sand in north and parts of central Texas.

Underlying the Comanchean are the Jurassic and Triassic formations. The Jurassic is the later of the two and consists chiefly of limestone. The only outcropping of this formation in Texas is in the Malone Mountains.

The Triassic formation consists largely of red clays and sand. This underlies the greater part of the Panhandle and the Llano Estacado where it extends over the Permian. The sands and conglomerate of this formation are usually a source of good water. Some gypsum and black oxide of manganese are sometimes to be found in this stratum.

The Anthracolitic formation is one of great importance because of its wide distribution and mineral content. The geologists have divided this system into three principal series known as the Permian (upper), the Pennsylvanian (middle), and the Mississippian (lower). Only two of these formations (the Permian and Pennsylvanian) have been definitely located in Texas.

The Permian formations are found in the Trans-Pecos Region and on the plains of northwest Texas. The thickness of the Permian is about 9,000 feet in the Glass Mountains and is composed largely of limestone. It also occurs in the Guadalupe Mountains, north and east of the Chinati Mountains. To a depth of approximately 1,500 feet the Permian in the Panhandle region consists largely of red marls and clays, commonly known as the "red beds." These beds also often contain beds of salt, frequently measuring 100 feet in thickness, and gypsum. Nearly

all the water secured from this stratum on the plains is salt or briny.

The Pennsylvanian underlies other formations over wide areas of Texas and outcrops at several places. It outcrops at several points in Montague and Clay counties on the northern border of the State. West from this section it dips under the Permian. The fact that it outcrops again east of the Front Range in New Mexico as well as in Texas seems to indicate that it underlies the entire Panhandle and the Llano Estacado. The Pennsylvanian formation has been penetrated by deep borings at San Angelo and at Spur. These borings indicate that this underlies older formations at a depth of 3,000 to 5,000 feet in northwest Texas. Outcroppings of this formation have also been found in the Franklin, the Hueco, the Chinati, and in some of the other mountains in the Trans-Pecos section.

The Pennsylvanian formation consists of shales sandstone, and limestone. These shales are almost free from Calcareous material. These materials range from dark or bluish-gray in the lower depth to reddish, brownish, or purplish colors in the upper part. The sands of this formation are comparatively fine and the grains are angular. Most of the water produced from this formation is brackish.

Formations of Devonian and Silurian are little known and of minor importance in Texas. The Caballos Novaculite, a strikingly white flint, found in Brewster County, is probably of Devonian origin. Silurian rocks have been found in the Franklin

Mountains, in the El Paso region, and perhaps they may exist in other sections of west Texas.

The Ordovician formation has been located in several sections of Texas. In the central part of the State it has been described as a limestone which is a hard, fine-grained, compact white rock that becomes rather coarse-grained in its lower depths. In this form it makes a continuous formation with the Cambrian. It has been located at a depth of 2,200 feet at Myra, in Cook County, and it has also been indicated by borings in an irregular area in Parker, Lampasas, and McCullough counties. It outcrops in McCullough, San Saba, Mason, Llano, Burnet, and Gillespie counties and at some places in the mountains in Brewster County. The limestone in the Hueco Mountains, in the El Paso region, is identified with this formation.

The Cambrian is the earliest formation of the Paleozoic and has been located in rather restricted areas in Texas. It occurs in San Saba, Mason, Llano, Burnet, Gillespie, and adjacent counties where it has been drilled into for water or for oil. The Cambrian may be described as gray or red sandstone. In its upper formation it is a hard dolomitic limestone. In the Trans-Pecos region the Cambrian formation is all sandstone. The best known rocks of the Cambrian are the Ellenburger limestone and the Van Horn, the Bliss, and the Brewster sandstone.

Pre-Cambrian or Archean rocks appear in only a very restricted area in Texas. A series of belts belonging to this system is called the "Llano Group".

It consists of schists and similar rocks with underlying and outcropping granites. Granite is a rock composed of quartz, feldspar, and mican. The feldspar is generally pinkish in color which has given to granite its characteristic color.

DRAINAGE SYSTEMS AND WATER RESOURCES

Texas is well supplied with water courses. Several river systems supply drainage for most of the area of the State. The principal rivers follow the general slope of the land and flow in a southeasterly direction to the Gulf, the Canadian River in the northwestern part of the State being the principal exception.

The relief of Texas is responsible for at least five kinds of drainage:

1. The drainage of the more recently formed Coastal Plain is characterized by stream channels only a few feet below the general level. These streams have relatively few tributaries and are not very long. There are divides between these streams that are at present undrained.

2. The streams that drain the older parts of the Coastal Plain are greatly aged and with their tributaries drain a larger area than the rivers of the more recent Coastal Plain lying nearer the Gulf. The rivers draining this larger area differ greatly in the number and importance of their tributaries and the area they drain. All of these rivers flow in a southeasterly direction in conformity with the

slope of the land. All have relatively low banks, wide bottoms, and are very sinuous. These rivers include the Sabine, Neches, Angelina, Trinity, the Sulphur Fork, the Red, the lower courses of the Brazos, the Colorado, the Guadalupe, the San Antonio, and the Neches. The entire courses of the Sabine, Neches, and the Angelina are confined to the Coastal Plain, while the other rivers that flow through this region have their sources in the Great Plains of the State.

3. The Central Basin of Texas is drained by the upper portions of the Red, Trinity, Brazos, and Colorado rivers. These are the oldest streams within the State. Their channels were gradually extended toward the present Gulf Coast line as the land surface was slowly elevated above the sea.

4. The upper courses of the Guadalupe, San Antonio, and Nueces rivers and their tributaries drain the plateau region of southwest Texas.

5. The fifth drainage system of Texas is that of the Rio Grande and its tributaries. This is the longest river that touches Texas soil. It has its source in southern Colorado. Its course crosses New Mexico and extends for more than a thousand miles along the Texas-Mexican border. The most important tributaries of the Rio Grande are the Pecos and Devil's rivers. There are several other smaller tributaries, such as the Rio Concho, the Sabinas, and the Salado rivers.

The Rio Grande is the oldest river in this section of the country. Geologically the history of this river

extends back at least to the early Tertiary (Eocene) period. Sediments of this period were brought down from the upper part of the river's course in Colorado and deposited in the Trans-Pecos region. The history of the river, during the latter Tertiary is in doubt, but it appears to have flowed through a comparatively level plain through the latter part of the Tertiary period. It seems about the end of the Tertiary (Pliocene), or perhaps during the early Quaternary (Pleistocene), an important change occurred throughout the lower area through which the river flowed. About this time the mountain ranges of the section were slowly uplifted across the course of the stream. However, the river succeeded in cutting down the rising elevation about as fast as the land surface rose. This process of erosion has resulted in a series of canyons that mark a part of its course.

Between El Paso and the Eagle Mountains the Rio Grande flows through a broad basin contiguous to the Hueco and Finlay mountains. From the point where the river enters the Eagle Mountains until it emerges from the Carmen Range, it alternately traverses canyons and plains. From this place to the mouth of the Pecos River it flows through almost a continuous rocky gorge. From the mouth of the Pecos to the Gulf the course of the stream flows through a level area similar to that of the other rivers of the Coastal Plain.

Only one other river requires description in this connection. This is the Canadian River that crosses the Texas Panhandle from west to east and flows into

the Arkansas River in eastern Oklahoma. This differs in many respects from the other rivers of Texas. The tributary creeks on each side of the stream in the Texas plain are short. They will probably not average more than thirty or thirty-five miles. The stream may be described as being wide, shallow, and sandy throughout its course in the Panhandle. The channel of the river is a sand bed averaging more than half a mile in width. Back of the sandy flood plain of the river are high bluffs. In places the stream is not more than two hundred yards wide where it flows between these bluffs. The Canadian River does not flow continuously throughout the year. It is notable for its sudden rises and treacherous quicksands.

The gradient of Texas rivers varies between rather wide limits. The Rio Grande, for example, at El Paso, which is 1,030 miles from its mouth, is 3,700 feet above sea level. At the mouth of the Pecos, near Del Rio, it is 1,000 feet above sea level. The Colorado has an elevation of 1,800 feet 519 miles above its mouth. The Clear Fork of the Brazos at Roby, 710 miles from its mouth, has an elevation of 1,900 feet. While the gradient of Texas rivers varies between rather wide limits, the waters of most of the streams flow with reasonable rapidity to insure good drainage throughout their entire courses. There are few sluggish streams in Texas.

The volume of Texas rivers varies greatly at different seasons of the year. The uniformity in volume is greatly affected by the wide variation in rain-

fall from season to season and from year to year in the upper courses of these streams. Some of the Texas rivers are subject to rather disastrous overflows at irregular intervals. Generally speaking, the rivers of Texas are not navigable to an appreciable extent. However, vessels of light draught may ascend some of the rivers for short distances from their mouths on the Gulf coast. Some efforts have been made by the Federal Government to make some of these rivers navigable by the construction of locks and dams. Up to the present time these efforts have not been successful. River navigation on an extensive scale does not appear to be very promising on Texas rivers. However, it is likely that in time some extension of river transportation may be made as a result of dredging, removing of obstacles, straightening their courses, and the erection of locks and dams. River improvements of this kind are needed, both for river navigation and for the control of flood waters.

The lakes of Texas are small and relatively unimportant. The larger lakes occur on the coastal slope and in the plateau region. The most important of the lakes on the coastal slope are Caddo Lake on the Louisiana-Texas boundary, Clear Lake in Harris County, Grand Lake in Montgomery County, Eagle Lake in Colorado County, Austin Lake in Matagorda County and Espantosa Lake on the line between Zavalla and Dimmit counties. There are also a number of small salt lakes on the Coastal Plain in the lower Rio Grande Valley. There are a number of

small bodies of water on the Staked Plains. These lakes were formed by the solution of underlying beds of salt, gypsum, and limestone. Some are salt. There is a small lake region between the Delaware Mountains and the Sierra Diablo which is the result of interior drainage.

CLIMATE OF TEXAS

The climate made a profound impression on travelers and colonists who came to Texas in an earlier day. Many of those who wrote of the climate described it in rather extravagant and poetic terms. This is probably due to the fact that many of those who came to Texas as travelers and prospective settlers were from foreign countries or northern states where the winters were long and severe, and the contrast in climatic conditions impressed them very profoundly. But whatever the cause, the Texas climate was generously praised and its favorable characteristics were widely known and discussed.

General Pike, for example, said of the Texas climate in the published narrative of his travels: "It has one of the most delightful temperatures in the world." Henry Clay, in contrasting Texas and Florida in Congress in 1820, said: "The climate of Texas is delicious, the soil fertile, the margins of the rivers abounding in live oak and the country admitting of easy settlement. I am not disposed to disparage Florida, but its intrinsic value is incomparably less than that of Texas." The author of "The Emi-

grant's Guide to Texas" describes his journey up the Brazos on January 3, 1840, by saying that he was impressed "with the perfect freshness and greenness of the grass, which bore more the appearance of a flowering spring than the rigors of mid-winter. In the woodland the birds were singing with all the vivacity and sweetness of spring. The weather was as mild as a northern May or June and woodpeckers, of which there were many varieties, were heard in every direction."

William Kennedy in his "Rise, Progress and Prospects of the Republic of Texas," published in London in 1841, devotes a chapter to the climate of Texas and its influence on health. "The climate of Texas," he says, "may fairly claim to be entitled a perpetual summer, admitting as it does of two or three crops a year of fruits and vegetables in great abundance and perfection." This writer, like many others, refers to winds and freezes of Texas, especially the "northers." He describes these winds as follows: "The 'northers', which are peculiar to Texas and the eastern coast of Mexico, generally follow a few days of rain and southerly winds. They burst forth suddenly with a gust of wind which almost checks respiration and seems to dry up all moisture of the skin; severe cold immediately succeeds and the thermometer frequently falls ten or twelve degrees within half an hour. Their average duration is three days; the clouds generally disappear a few hours after their commencement, leaving a clear, cold sky. Coming from a point west by north, they depress the mer-

cury in the thermometer lower than easterly winds, but they are regarded as less prejudicial to health. During the summer months, 'northers' are of rare occurrence, and their rude visits are not an unmixed evil, as they tend much to purify the air. The shelter of the groves and woods affords sufficient protection to cattle from their assaults."

In contrast with the "northers", Kennedy describes the cooling breezes of the summer as "the sweet south-western breeze which is so accessary to health and comfort on the level regions of the coast." In commenting on the high temperatures of the summer months he says: "But the graduation of the thermometer can convey no accurate idea of the climate of Texas to those who have never experienced its effects. From the same degree of heat which in New Orleans was overpowering and relaxing, I suffered comparatively little inconvenience, even in Houston, a town situated in a low-lying and rather insalubrious prairie. So steady, bracing, and cooling was the breeze, that it not only mitigated the heat, but enabled me to take pedestrian exercise with safety in the open prairie at mid-day in the fervid month of June; and so potent was this affectionate and welcome wind, that I was obliged, when writing, to close the southern window of my apartment, to prevent my books and papers from being whirled off the table where they lay."

The climate has always been emphasized in presenting the advantages of Texas as a place in which to live. Most of the volumes of the Texas Almanac,

whose subtitle in the early issues was "The Emigrant's Guide to Texas," devoted considerable space to praising the climate. The volume for 1869-70 is typical. After contrasting "the superior salubrity" of the Texas climate with the extremes of heat and cold of the North, the writer says: "The farmers of Texas may be seen plowing, sowing and planting every month of the winter, and the herds are grazing and calves and lambs frisking and playing on the green prairies, at the very time the northern states are covered with deep snow and the rivers and ponds are frozen so as to compel the suspension of all water-power mills and all navigation." Much of the early writing on the Texas climate was inspired by pleasant impressions. While these descriptions were reasonably accurate for certain localities, they were not based upon accurate observations. Scientific daily records are now being kept of rainfall, temperatures, and other weather phenomena by the Weather Bureau of the United States Department of Agriculture. The Texas Agricultural Experiment Station also keeps weather records at the Agricultural and Mechanical College of Texas and at each of its thirteen sub-stations. Observations and measurements of rainfall are made at about two hundred points in the State and at most of these points general climatological data are taken. Some of these records have run for many years. That at Austin, for example, has continued for sixty-six years, while several others have run more than fifty years.

Crop production in Texas is aided by the accurate

records of weather conditions. Due to the wide range in latitude, longitude, and altitude, there are in the State quite a large number of distinct climatic regions. Fig. 2 shows the location of about twenty-five points at which weather records have been taken, each of which is fairly representative of a rather large region. The locations of the Experiment Station field laboratories are also indicated on this map, at each of which experiments are conducted with crops peculiarly suited to that region. These sub-stations represent fairly well the several climatic regions of the State, as well as the different soil areas. With the further development of the agriculture of Texas, field laboratories or sub-stations will naturally be established in other regions until no section of importance will be without the aid of special scientific investigations on behalf of its agriculture. Thus the climatic and soil resources of the State are being made increasingly available to the agricultural producers.

Charts have been prepared, Figs. 2 and 3, presenting the records of these twenty-five regional points, showing the average monthly rainfall, the elevation above sea-level, the period during which records have been kept, the average annual rainfall, the mean monthly temperatures, the means of the maximum and the minimum monthly temperatures, the unusual low temperatures which prevailed in February, 1899, and the average dates of the last frost in the spring and of the first frost in the fall.

The precipitation chart shows much lighter rain-

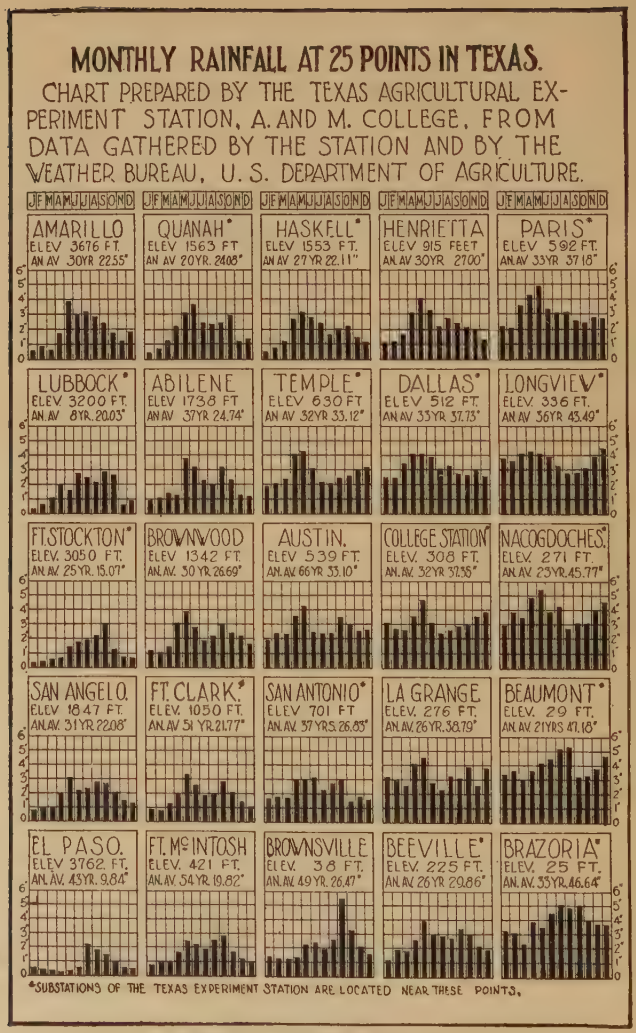

FIG. 2.—Rainfall chart.

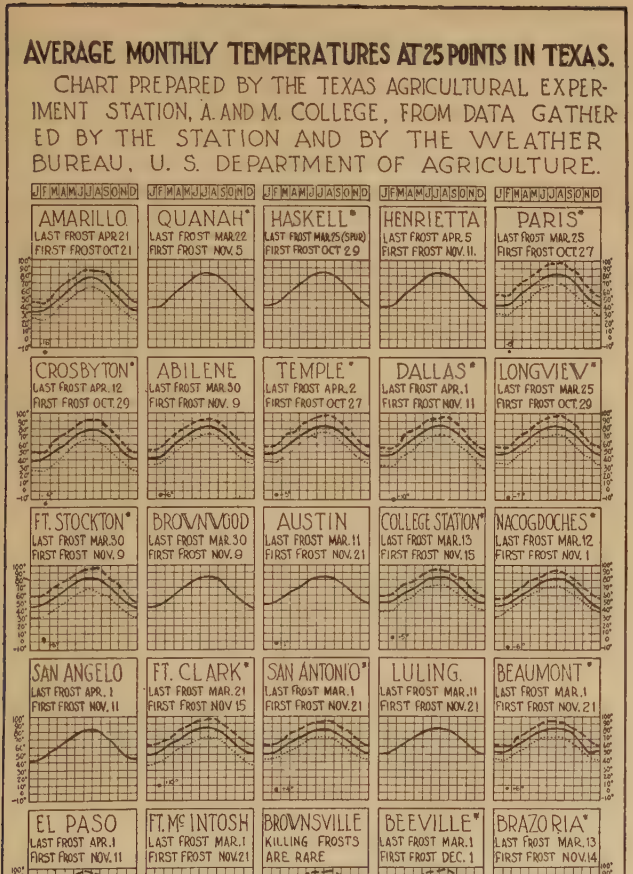
AVERAGE MONTHLY TEMPERATURES AT 25 POINTS IN TEXAS.
CHART PREPARED BY THE TEXAS AGRICULTURAL EXPERIMENT STATION, A. AND M. COLLEGE, FROM DATA GATHERED BY THE STATION AND BY THE WEATHER BUREAU, U. S. DEPARTMENT OF AGRICULTURE.
J F M A M J J A S O N D
AMARILLO
LAST FROST APR 21
FIRST FROST OCT 21
QUANAH*
LAST FROST MAR 22
FIRST FROST NOV. 5
HASKELL*
LAST FROST MAR 25 (SPUR)
FIRST FROST OCT 29
HENRIETTA
LAST FROST APR. 5
FIRST FROST NOV. 11.
PARIS*
LAST FROST MAR. 25
FIRST FROST OCT 27
CROSBYTON*
LAST FROST APR. 12
FIRST FROST OCT. 29
ABILENE
LAST FROST MAR. 30
FIRST FROST NOV. 9
TEMPLE*
LAST FROST APR. 2
FIRST FROST OCT 27
DALLAS*
LAST FROST APR. 1
FIRST FROST NOV. 11
LONGVIEW*
LAST FROST MAR 25
FIRST FROST OCT. 29
FT. STOCKTON*
LAST FROST MAR. 30
FIRST FROST NOV. 9
BROWNWOOD
LAST FROST MAR. 30
FIRST FROST NOV. 9
AUSTIN
LAST FROST MAR. 11
FIRST FROST NOV. 21
COLLEGE STATION*
LAST FROST MAR. 13
FIRST FROST NOV. 15
NACOGDOCHES*
LAST FROST MAR. 12
FIRST FROST NOV. 1
SAN ANGELO
LAST FROST APR. 1
FIRST FROST NOV. 11
FT. CLARK*
LAST FROST MAR. 21
FIRST FROST NOV 15
SAN ANTONIO*
LAST FROST MAR. 1
FIRST FROST NOV. 21
LULING.
LAST FROST MAR. 11
FIRST FROST NOV. 21
BEAUMONT*
LAST FROST MAR. 1
FIRST FROST NOV. 21
EL PASO
LAST FROST APR. 1
FIRST FROST NOV. 11
FT. Mc INTOSH
LAST FROST MAR. 1
FIRST FROST NOV. 21
BROWNSVILLE
KILLING FROSTS ARE RARE
BEEVILLE*
LAST FROST MAR. 1
FIRST FROST DEC. 1
BRAZORIA*
LAST FROST MAR. 13
FIRST FROST NOV. 14
* TEXAS EXPERIMENT STATION OPERATES A SUBSTATION NEAR EACH OF THESE POINTS.
THE AVERAGE FROST DATES ARE FROM 10 TO 20-YEAR RECORDS.
LEGEND:- —— MEAN AVERAGE; - - - - MEAN MAXIMUM; ····· MEAN MINIMUM; *LOWEST IN 20 YEARS.

FIG. 3.—Temperature chart.

fall in the far western portion of the State than in the eastern part, and that it increases regularly from west to east. It is interesting to note that in the western sections, where the rainfall is lighter, the monthly distribution is most ideal, the heaviest precipitation occurring during those months when the crops need the greatest amount of moisture. In the eastern and southeastern sections, the winter months show heavy rainfall, but crops suitable to those areas seem to require this sort of distribution.

At Fort McIntosh (Laredo), Fort Clark (Bracketville), San Angelo, Brownwood, Abilene, Austin, La Grange, San Antonio, Beeville and Brownsville, two distinct growing seasons are indicated in the rainfall chart. The months of April, May, and June have good rainfall. During the extreme hot season of July and August, the rainfall is reduced, but increases for September and October. Due to the length of the growing season at these points and to the fact that moisture, and not frost, is the limiting factor, the farmers are able to produce generally two crops a year, one in the spring and one in the fall. Fig. 4 indicates the climatic regions of Texas.

Considering the monthly and the annual averages of both temperature and precipitation, or even the daily averages for that matter, it would be difficult to picture a more ideal climate for crop and livestock production. However, no part of the State is entirely free from sudden changes of temperature, which invariably occur following great cyclonic and anti-cyclonic disturbances of higher altitudes. The

southward movement of anti-cyclones brings cold waves, to which reference has been made, known as "northers". Occasionally these cold waves bring

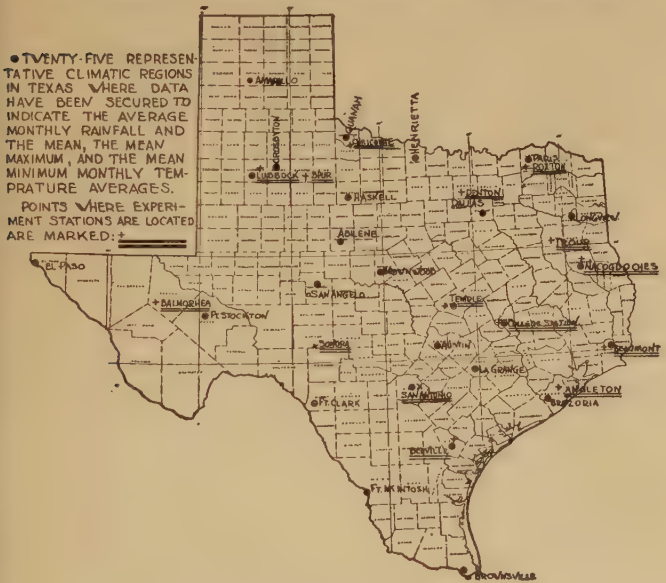

FIG. 4.—Climatic regions of Texas.

freezing weather as far south as the Gulf Coast. But more often their effects are neutralized by the warm waters and winds of the Gulf Coast regions. The cold waves are much more severe in northwest Texas and of greater frequency than in south Texas. The average number of days of freezing is only three per

annum for the east coast and seven for the lower Rio Grande Valley, but the number increases to 111 in the Panhandle. Snow rarely comes in the Coast country. The snowfall is heaviest in the northern part of the Panhandle. The average amount in this section is from nineteen to twenty-two inches. The decrease southward is rapid, being an average of only eight inches in the lower Panhandle. February is usually the month of heaviest snowfall in Texas.

Wind movement is an important influence, both on rainfall and physical comfort or discomfort. The average hourly velocity for the wind during the year is from ten to twelve miles an hour on the coast and in east and central Texas, eleven miles in the extreme west and sixteen miles in the Panhandle. The wind movement is greater during the colder than the warmer months, but it is usually strong enough in summer to give a decidedly cooling and invigorating effect. Dry hot winds sometimes increase discomfort in the summer in central and north Texas, but usually a gentle breeze from the Gulf at night insures reasonable comfort over most of the southern part of the State.

In some sections, however, the departures from normal, especially in precipitation, are sometimes quite marked, so that disastrous droughts are not uncommon, though these disasters are usually confined to rather limited regions, as compared with the area of the whole State. The occurrence of precipitation depends largely on the direction of the wind. During the cold season when there is a large percentage of

northerly winds which are dry, precipitation is comparatively small, but with the advent of spring the moisture-laden southerly winds are accompanied by heavy rains. Spring is usually the season of greatest precipitation in the middle and eastern parts of the State, summer in the southwestern, western and Panhandle sections, and fall along the coast.

CHAPTER II

THE SOILS OF TEXAS

Texas, with a land area of 262,290 square miles, has a large variety of soils, on which are grown a great number and diversity of crops. These soils range through all the intermediate classifications of texture and structure from the loose deep sand to heavy dark clays; in color from light gray to deep black with various other colors of many shades and tints; and in origin from residual soils derived from the weathered very old geological formations on through many successive formations up to the alluvial deposits of very recent time.

Thus far many of the soils of Texas have been mapped and studied in detail, but there remain a large number that have not as yet been studied. The work of classifying and mapping the soils of the State is being continued by state and national scientists and it is hoped that in a few years a complete soil map will be available.

Many persons unacquainted with Texas think of the State as being a land of only broad rolling prairies with dark heavy soils. While much of Texas is prairie, there are vast areas of sandy soils covered

with timber growth; some rough and stony sections supporting a sparse and scrubby vegetation; scantily timbered semi-prairie lands; and western light-colored alkali soils supporting little grass but much thorny scrub-like growth.

There are a number of regions in Texas where topography, native vegetation, and climatic conditions have given characteristic surface features and soils. Progressing in a northwest direction from the southeastern corner of the State, one passes over flat coast prairie onto rolling areas of sandy timbered soils, and rolling broad prairies of black heavy soils, stony prairies more or less rough, western plains of red and chocolate soils, and finally up on to the high plains of northwest Texas where the level prairie lands of brown and chocolate soils lie from 2,500 to more than 4,000 feet above sea level. Going westward from the east side of the State one remains in the broad belt of rolling timber sandy lands for more than one hundred miles. Continuing westward, successive broad prairies are passed over, each with characteristic soils, vegetation, and topography with occasional strips of rough or sandy timbered lands interspersed between. Continuing westward through the State, climatic conditions change from the humid to the semi-arid type and finally in the extreme western part where the climate is arid there are level areas of alkaline soils with some rough mountain ranges towering thousands of feet above the adjacent plains. The climatic conditions not only exert a great influence on the crops produced on the soils, but have also

been a very important factor in the formation of the different soils.

A study of the many soils of Texas and their various crop adaptations shows a close relationship of the soils to parent soil material (geological formation), topography, climate, and crop utilization.

As stated, there are a number of physiographic regions within the State, each having characteristic features of topography, geological formation, soils, and native vegetation. These different regions have various groups of soils peculiar to them, and more or less related through common origin, color, and crop adaptation.

These various regions of Texas are known by certain names which have been given by reason of some outstanding feature of topography, vegetation, or other prominent surface condition. The soils of the State as discussed here will be taken up with regard to each of these regions. It is impossible, in a short discussion of the soils of Texas, to give more than a very brief description of the main groups.

The main divisions of Texas as regards soil regions are as follows: (See Figs. 5, 6.)

(1) The Gulf Coast Prairie
(2) The East Texas Timber country
(3) The Rio Grande Plain
(4) The Black Prairie region
(5) The Eastern Cross Timbers
(6) The Limestone region
(7) The Western Cross Timbers (with soils of the associated Carboniferous formations).

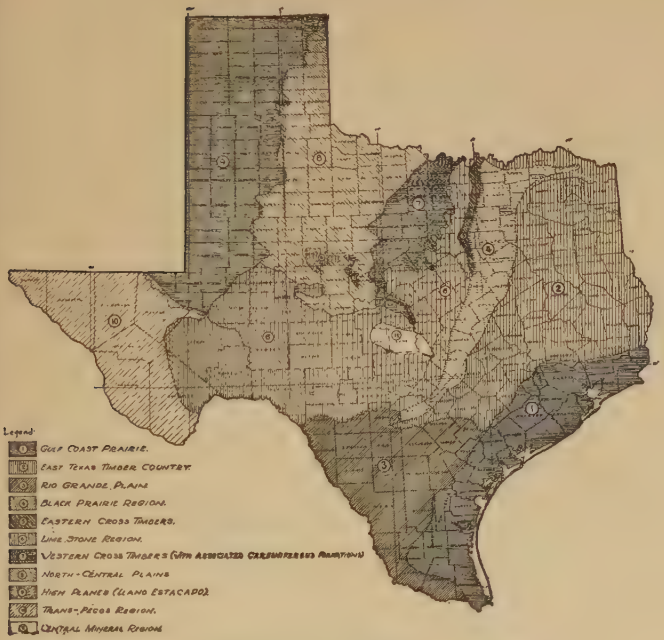

FIG. 5.—Main surface divisions of Texas.

(8) The Northern Central Plains
(9) The High Plains (Llano Estacado)
(10) The Trans-Pecos region
(11) The Central Mineral region

THE GULF COAST PRAIRIE

The Gulf Coast Prairie of Texas consists of a strip of level prairie lands forty to 100 miles wide bor-

AMARILLO
WICHITA FALLS
DALLAS
TYLER
EL PASO
SAN ANGELO
HOUSTON
LAREDO
SOIL SECTIONS OF TEXAS.
1. BREAKS OR "BAD LAND". 2. HIGH PLAINS.
3. MOUNTAINS & VALLEYS. 4. RED PRAIRIES.
5. EDWARDS PLATEAU. 6. WEST CROSS TIMBERS.
7. HILLS OF CRYSTALLINE ROCKS.
8. EAST CROSS TIMBERS. 9. BLACK BELT.
10. SOUTH TEXAS RED LANDS. 11. RIO GRANDE PLAINS.
12. INTERIOR COSTAL PRAIRIES. 13. INTERIOR FLAT-WOODS. 14. GULF COAST PLAINS.

FIG. 6.—Soil sections of Texas.

dering the Gulf of Mexico, and reaching from Louisiana on the east to Mexico on the west.

This prairie gradually rises from only a few feet above sea level at tidewater to around 100 feet in the eastern part, and over 200 feet in its westerly extension. The surface is nearly level but has a gradual and regular, though imperceptible, slope towards the coast.

The eastern half of this prairie lies within the humid region of the State and has a native growth of many kinds of wild grasses, with occasional strips of pines and other timber bordering the larger streams which cross the prairie, the stream-bottom lands also being heavily timbered. The western half of the Coast Prairie, which has a decided southerly trend in direction, lies within the region of less rainfall (0 to 30 inches annually) and here the native grass is largely mesquite, while a scattering growth of small mesquite trees is found in many sections, and certain areas near the coast have a growth of small live oak trees and some laurel.

The humid or eastern portion of the Coast Prairie is bordered on the Gulf Coast by considerable strips and bodies of marsh lands, while all of the main part is flat and poorly drained or drains very slowly and water often stands on the surface for a long time after rains. The western portion of the Coast Prairie, though quite level, does not suffer so much from poor drainage on account of the lighter rainfall.

The soils of the Coast Prairie consist of comparatively recent sediments deposited by streams in the shallow waters of the Gulf. These range in texture from loose sandy soils to heavy clays. Some soils of intermediate textures also occur, consisting principally of fine sandy loams, loams, silt loams, and clay loams.

Nearly all the coast of Texas is skirted by narrow

islands a few miles from the mainland. These islands consist mainly of loose fine sand, light in color and of little or no agricultural value. This is the Galveston fine sand.[1] It blows into dunes which are constantly shifting and changing in the wind. In areas in which the natural vegetation of grass keeps the sand from blowing, a scant pasturage is afforded to live-stock. On the margin of the western Coast Prairie are some areas of light-colored fine sand resembling the Galveston but having a clay subsoil at several feet deep. This is the Nueces fine sand. A low growth of small live oak trees, a few feet high, grows over much of this soil. In places the sand drifts into dunes, but where protected from the wind fair yields of vegetables, grapes, figs, and some other crops may be grown. A large area of this soil reaches from the coast in Willacy County westward nearly seventy-five miles.

The Lomalta soils occur near the coast border. These are dark colored, marshy in places, supporting a growth of salt and marsh grasses. Only small areas of these soils are suitable for cultivation, owing to wet and marshy conditions; while in some places there is too much salt in the soil. Occasional areas of fairly good drainage are utilized for corn, cotton, and vegetables. The important soils of the humid or eastern part of the Coast Prairie are the Lake Charles, Crowley, and Edna. The Lakes Charles soils

[1] The names of the soils and the soil series here given are the official names used by the Bureau of Soils, U. S. Dept. Agr.

PLATE II. A typical forest scene in east Texas.

are gray to dark colored non-calcareous prairie soils; the Crowley are light colored non-calcareous prairie soils of very poor drainage; while the Edna are gray prairie soils with mottled heavy subsoils. Some small timbered areas of the Coast Prairie have gray non-calcareous soils known as the Arcadia series. The better drained soils of these series are, as a rule, the fine sandy loams, while the heavier types are more poorly drained. These soils are cultivated to some extent, and rice, one of the principal crops, is extensively grown on the heavier types. Some cotton and corn as well as sorghum are also grown, and small amounts of vegetables are produced on the lighter textured better-drained soils of these series.

In the western part of the Coast Prairie where the climatic conditions are semi-arid, or approximately so, the main soils are of the Victoria series; these being dark colored calcareous soils. Here the vegetation is largely mesquite grass with a thin straggling growth of small mesquite trees, though in some places the tree growth is rather thick. These soils are used largely for the production of cotton, corn, and vegetables.

Large bodies of land on the Coast Prairie are as yet utilized only for cattle grazing. The eastern section has insufficient drainage in many places for the production of farm crops, though drainage projects are being undertaken to relieve this condition. In the western section the rainfall is often uncertain and, while many of the general farm crops are raised,

some irrigation has been necessary to insure regular production.

The soils of the Coast Prairie are, as a rule, quite productive when problems of moisture conditions are overcome by artificial drainage or by irrigation.

All the main rivers of Texas cross this prairie before emptying into the Gulf. These have broad low bottom lands which are frequently poorly drained and subject to overflow. These alluvial soils are principally of the Trinity and Miller series. The Trinity are dark colored calcareous soils derived mainly from sediments washed from the Black Prairie lands of central Texas, while the Miller soils, found mainly along the Colorado and Brazos rivers, are red to chocolate calcareous soils representing deposits of sediments washed mainly from the Permian Red Beds of the north Central Plains. These alluvial soils are very productive and, where drainage conditions are good, are utilized for the production of corn, cotton, and other crops.

EAST TEXAS TIMBER COUNTRY

Just north of the Gulf Coast Prairie in eastern Texas there is a large area of approximately 40,000 square miles known as the East Texas Timber country. This is the westerly extension of the Atlantic Gulf Coastal Plain, reaching through a number of states on the Atlantic and Gulf seaboard. This region in Texas extends northward from the Coast Prairie to the northern border of the State

and westward from Louisiana for a distance of about 100 to 300 miles. It is bordered on the west mainly by the Black Prairie region. Geologically the soil material is of old unconsolidated marine sediments of Tertiary age.

The East Texas Timber country lies from approximately 100 to several hundred feet above sea level, and has a generally rolling topography. In places erosion has carved a hilly to very rolling surface with some steep slopes, while in other localities there are considerable bodies of level poorly drained soils, especially in the southern part.

There are many kinds of soils in this region of the State, but the sandy soils predominate. The fine sandy loams are the most extensive types, these comprising sandy surface soils with clay subsoils. The heavy soils usually occupy the more level areas. Some extensive bodies of deep sands are located in this region. As a rule, the soils of this section occur in many small bodies so that most farms have several kinds of soil on them. The region is heavily timbered with pines, with some oaks, though in places the oak timber predominates.

In this part of the State the principal agriculture is the production of cotton, corn, and forage crops, such as sorghum. Fruit is grown to some extent, peaches being the main commercial crop. Small amounts of sorghum and sugar-cane are planted and sirup is made in a small way for local use. Some cigar tobacco has been grown very successfully, but little is produced commercially at the present time.

Small numbers of cattle and hogs are raised on most farms. Many of the soils are well suited to vegetables, small-fruits and berries, and these are universally grown for local use, but only small amounts for shipping to outside markets. This part of Texas is well settled in most sections and much of the land is in small farms.

The soils are non-calcareous and fairly productive and are very susceptible to improvement by utilizing the resources of the farm, such as manuring, growing leguminous crops, and maintaining a good amount of humus by plowing under vegetation. Nearly all of the small amounts of commercial fertilizers used in the State are in this region. The soils are easily run down and impoverished by incorrect methods of farming. Cotton is the main money crop in this region, while nearly everything required for food is, or may be, raised on the farm.

The main soils of the East Texas Timber country vary considerably in surface and subsoil characteristics and in productiveness. The main soils of the region have either red, brown, or gray surface soils, with red, yellow, gray, or mottled clay subsoils.

The Orangeburg are important and productive soils of this region. These have surface soils gray to brown in color with friable red sandy clay subsoils. These soils are well drained and well suited to cotton, corn, fruit and vegetables, and to tobacco. The Orangeburg fine sandy loam is the most extensive as well as the most productive type of the series.

The Greenville soils differ from the Orangeburg in that the surface soils are red to reddish-brown in color. These are also productive soils, the fine sandy loam being the most important.

The Norfolk soils are extensive. These have gray surface soils with sandy or sandy clay subsoils of yellow color. The most extensive soil types of the Norfolk series are the fine sandy loam and fine sand. These are less productive than the Orangeburg and Greenville soils, but good crops may be raised on the fine sandy loam with proper care. The Caddo soils, somewhat less important, differ from the Norfolk mainly in that the lower subsoils are mottled gray and yellow. The Caddo fine sandy loam is the main type of the series. It is rather level and of fair agricultural value. The Ruston soils are well drained and rather extensive, the fine sandy loam predominating in the Ruston series. These soils have gray or brown surface soils with friable reddish-yellow or brown friable subsoils. These soils are fairly productive, the fine sandy loam being only a little less productive than the Orangeburg fine sandy loam, but more so than the Norfolk or Caddo fine sandy loams.

The Susquehanna consists of gray brown surface soils with heavy plastic red clay subsoils mottled more or less with gray and yellow. These have only fair drainage in many places and are not so productive as the Orangeburg, Greenville, and Ruston soils. The Susquehanna fine sandy loam is a rather extensive soil type in certain parts of this region.

The Lufkin soils are rather extensive in the south-

ern part of this region. These are gray soils with very heavy gray clay subsoils, often mottled with yellow. The Lufkin soils are usually nearly level to quite flat and drainage is frequently poor. The Lufkin fine sandy loam is an extensive soil type, though some large areas of the Lufkin clay also occur. Until adequately drained the Lufkin soils are of low agricultural value in many places, though by expert treatment some areas produce good crops.

The Kirvin are brown to reddish soils, having heavy plastic red subsoils. Often a considerable amount of small ferruginous sandstone fragment is found in the surface.

Occasional small prairies occur within this region. These are usually occupied by the Crockett soils which are dark to black surface soils with clay subsoils of red or red mottled with other colors. These soils also frequently occur along the border of the Black Prairie region where it merges into the East Texas Timber country.

In the northern part of the East Texas Timber country the Bowie soils are found. These have gray to brown surface soils with mottled red, yellow, and gray friable subsoils.

All the soils of the East Texas Timber country are utilized for about the same crops.

Considerable areas of alluvial soils occur in the river and creek bottoms which flow through and drain this region. The amount of alluvial soils of the region ranges from approximately 10 to 20 percent of the area of some counties. These differ according to

the soil material of the region from which the sediments have been washed. The local streams which rise within the East Texas Timber country have soils gray to brown in color with gray or brown subsoils more or less mottled. These are non-calcareous soils of the Ochlockonee and other series. On some of the creeks and branches these soils of sandy texture are utilized successfully to some extent for growing sugar-cane from which very fine sirup is made on the farms by small manufacturing outfits. Cotton and corn are also grown successfully when overflows do not come and damage or destroy the crops. The larger streams passing through the region have bottom lands consisting largely of black soils belonging to the Trinity series, brown soils belonging to the Catalpa series, and red or chocolate soils of the Miller series. These soils are calcareous and, where not subject to damaging overflows, are utilized extensively for growing cotton and corn. Being poorly drained, however, and subject to overflows, large areas are not utilized but remain with heavy forest of hardwood.

THE RIO GRANDE PLAIN

The Tertiary sediments comprising the East Texas Timber country extend in a southwesterly direction and form a region in south Texas, where, though many of the soils are sandy, the soil material and climatic conditions are such as to give a distinctly separate region. This section, reaching from San Antonio to Laredo and from the Rio Grande

eastward approximately 200 miles, has no well known distinctive name, being locally termed "southwest Texas," even though geographically it is a part of south Texas. This region has been called the Rio Grande Plain by some writers.

The old marine sediments of the Rio Grande Plain are somewhat different from those of the East Texas Timber country. That is, the soil material of the Rio Grande Plain has more of a western origin than that of the deposits of the same age farther east. In addition, the Rio Grande Plain lies within the semi-arid region of the State and this climatic difference has influenced the soils in their formation, has given a characteristic vegetation, and has placed a limiting factor on the utilization of the soils to a considerable extent.

The Rio Grande Plain has no sharp boundary where it joins the Coast Prairie. These two regions merge together gradually, the plain rising to about 800 feet above sea level on the northern border where it joins the Edwards Plateau. On the east the plain also merges gradually into the East Texas Timber country.

The surface ranges from level to gently rolling, with some hilly country and rough broken areas. The land is well drained and lies in the region of light rainfall and, therefore, the question of drainage is not generally important. Along the Rio Grande and some other streams which cross the plain there are some wide bottom or valley lands. Here, as well as on some of the upland soils, considerable

attention is being given to irrigation, and this has proven a successful aid in growing crops. The water for irrigation is obtained from streams, wells, and in places from impounded storm water in reservoirs. However, in certain sections considerable farming is practiced without irrigation. Many of the smaller streams have no water in them except during rainy reasons. Stock-raising, mostly cattle ranching, has long been the main occupation of the Rio Grande Plain, and farming has been confined largely to the river valleys and to more thickly settled districts near towns and railroads.

While much of the Rio Grande Plain is prairie land, a considerable part of the country has a scattering to rather thick growth of mesquite trees, as well as some live oak in certain sections. There are many of the thorny shrubs known as chaparral, as well as various other cacti. Some of the river bottom lands support a rather heavy growth of pecan, elm, hackberry, and other trees.

There are many kinds of soils in the Rio Grande Plain. Most of them are quite productive when moisture conditions are favorable. Cotton, corn and forage plants are the general farm crops grown in the comparatively small acreage under cultivation. Vegetables are produced commercially in large quantities under irrigation in certain sections, onions being a very important crop around Laredo and some other places. Citrus-fruits are also grown to a considerable extent in the southern part of the region.

Most of the soils of the Rio Grande Plain are cal-

careous. These range from fine sandy loams to clays in texture. Only the main soils of the region are discussed here.

Considerable areas of reddish soils occur within this region. Of these the Duval soils are quite important. These have reddish surface soils with red subsoils. The Duval soils are quite productive and are very similar to the Webb, which have brown to reddish surface soils with reddish-brown or red subsoils. The Webb soils, as a rule, have a larger lime-content than the Duval. The fine sandy loams are the most extensive types of the Duval and Webb soils.

There are large areas of dark brown to black soils. Of these the Houston have gray calcareous subsoils; the Goliad have red or reddish-brown calcareous subsoils; and the Crockett have red subsoils mottled with yellow or brown. These dark soils are quite productive and the heavy types are more extensive than the sandy soils of these series.

The Brennan soils are important in this region. They are gray to light brown with grayish or light brown subsoils. The Zapata soils are also grayish with light colored subsoils. The Zapata soils have a more rolling and rougher topography than the Brennan. The Maverick soils are gray to light brown in color with brown to yellowish subsoils.

The alluvial soils of the region occur along the rivers and smaller streams and are usually very productive. These are: dark colored soils belonging to the Trinity and Cameron series; the Frio soils which

are brown in color; and the Uvalde, Blanco, and Laredo soils which have a gray color.

In the section around Brownsville and other places in this region, there are some very extensive irrigation projects and many kinds of farm crops and vegetables are grown under irrigation.

BLACK PRAIRIE REGION

Just west of the East Texas Timber country lies a strip of black prairie lands reaching from the Red River in a south-southwesterly direction in an ever narrowing wedge which ends in the vicinity of San Antonio. In its widest place this area is only about fifty miles wide, and the total size of this region is approximately 10,000 to 12,000 square miles. This is known as the Black Prairie region of Texas, so called from the very black heavy soils. The Black Prairie region is subdivided into a number of prairies, each having a characteristic geological origin, but on the whole these differences are not so great as to constitute great variation in soils, vegetation, or crop utilization.

The Black Prairie region is a rolling prairie 400 to 800 feet above sea level, with only small areas of hilly land or steep slopes. The prairie was originally covered with a rank growth of native grasses, one of the most valuable for grazing being mesquite grass. The southern part has a scattering growth of mesquite trees. A number of rivers and small streams cross the region, these having carved deep broad val-

leys which support a native timber growth of elm, hackberry, pecan, and other trees. The drainage is good throughout this section. The small streams are dry except during wet seasons. Over much of this territory artesian water is secured, and in places a good supply in shallow wells. Shallow well water in many places, however, does not last throughout the dry seasons.

This region of Texas supports the densest population in the State. Nearly all the land of the Black Prairies is in a high state of cultivation and only a small amount remains in the native sod.

Cotton is the principal crop, although considerable wheat, oats, corn, and forage plants are extensively grown. Miscellaneous other crops are raised in a small way.

The soils of this region have (with the exception of the alluvial soils) been derived from the weathering of chalk, marls, and calcareous clays. Geologically the parent soil material belongs to the Upper Cretaceous.

The greater portion of this region comprises heavy dark colored to black soils. The Houston soils constitute the most extensive areas. These are dark brown to black soils with brown, yellow, or gray subsoils. These soils are typically calcareous and mostly very productive. The soils have mostly weathered deeply except for small areas along the White Rock Escarpment where the underlying parent chalk material has, through erosion, been brought near the surface. The Houston Black Clay, the most extensive

and prominent soil type of this region, is given the local name "black waxy land" or "hogwallow" land, owing to the adhesive quality of the soil when wet and on account of the numerous slight elevations and depressions over the surface of the native prairies that are known as "hogwallows." This condition of the surface was caused by the shrinking and cracking of the soil in dry seasons, with the subsequent washing of the soils into well rounded elevations and smoothly cupped depressions by the action of rain water. When cultivated the soil does not break into cracks so much and the "hogwallow" condition soon disappears. The Houston soils are very productive and little attention is given to keeping up their native fertility. While the productiveness of these soils on the more level areas has not decreased noticeably, the sloping lands are found to deteriorate slightly with long continued cultivation unless methods are used to prevent erosion and loss of organic matter.

Small areas of the Ellis soils are also found in this region. These are brown to yellow, underlaid by yellow or brownish subsoils which have a greenish color. These soils are derived from non-calcareous clays and shales and are not of great agricultural value except in some favored areas in which the small grains give good yields.

Some areas of the Wilson soils occur which are dark, resembling the Houston soils but which are non-calcareous. Along the marginal borders of the adjacent timbered regions small areas of the Crockett soils are found. These resemble the Houston soils

on the surface but are non-calcareous and have reddish mottled subsoils.

The alluvial soils of the region are subject to overflow and are largely dark colored calcareous soils of the Trinity and Catalpa series, though where the Colorado and Brazos rivers cross the Black Prairies the bottom lands of these streams are composed principally of the red and chocolate colored soils of the Miller series. Bordering the larger stream valleys of the Black Prairie region are a number of old alluvial soils lying as terraces high above the present flood plains of the streams. These are, when black and calcareous, of the Bell series, and when dark gray to black and non-calcareous, of the Irving series. When brown in color and calcareous, these soils are of the Lewisville series. The Cahaba soils also occur here, being gray to brown with red friable subsoils, and the Leaf soils with heavy red mottled subsoils also are found. Other unimportant soils occur on these terraces. All of the old stream terrace soils are quite productive. The Bell, Irving, and Lewisville series are usually represented more largely by the heavy soils, while the Cahaba and Leaf soils are principally fine sandy loams.

A number of small prairies of the soils belonging to the Black Prairie region occasionally occur in the East Texas Timber country and in the Rio Grande Plain. The largest of these are found within that general region in south Texas where the Rio Grande Plain, the East Texas Timber country, and the Black Prairie region merge together, or mainly in

McMullen, Live Oak, Karnes, Wilson, Dewitt, Lavaca, Fayette, and Bee and Washington counties.

EASTERN CROSS TIMBERS

A narrow strip of timbered sandy country extends southward from the Red River in northern Texas as far as Hill County, known as the Eastern Cross Timbers. This strip is bordered on the east by the Black Prairie region and on the west by the Fort Worth Prairie subdivision of the Limestone region. This is a rolling to hilly country covered with a timber growth chiefly composed of post oak and black jack oak.

A considerable part of this region is cleared and cultivated, the crops being mainly cotton and corn, with some fruit and vegetables for local use. The soils represent old unconsolidated marine sediments. They are principally sandy in texture, non-calcareous, and have clay subsoils. The Kirvin soils are the most important, being brown to red surface soils with heavy red subsoils more or less mottled with gray and yellow. A characteristic feature is the presence in the soil material of ferruginous sandstone fragments, ranging in size from fine to coarse, and in places giving a stony condition. The Kirvin fine sandy loam is the most extensive soil type in this region.

Small areas of Ruston, Norfolk, and Susquehanna soils as well as some others are also found in this region.

THE LIMESTONE REGION

There is a large area of soils extending through central and western Texas, that are derived from the weathering of the hard (Comanchean) limestones and interstratified marly material of the Lower Cretaceous formations. This region covers an area of many thousand square miles, and has been carved by erosion into various physiographic forms. These different forms of topography are peculiar to certain sections of the region and certain descriptive names are used for each of these. At one time this region was a plateau covering a much larger territory than is shown by the present areas of limestone. The main area of the Limestone region lies in central western Texas and is known as the Edwards Plateau. An extension on west of the Pecos River is known as the Stockton Plateau. The greater portion of these plateaus lies from 2,000 to 2,500 feet above sea level. Here the surface has been greatly eroded and much of the plateau washed away, leaving some high rolling areas with many cut and eroded valleys with steep stony slopes. On some of the broader high divides the surface is level and plateau-like.

At the eastern side of the main limestone area a long arm of limestone lands reaches from the Edwards Plateau northward (between the Eastern and Western Cross Timbers) to the northern border of the State. Here, however, erosion has removed a large portion of the upper layers of limestone material. This general region of limestone lands reach-

ing northward from central Texas is known as the Grand Prairie.

The Grand Prairie ranges from 1,000 to 2,000 feet above sea level. The northern part is occupied to a considerable extent by comparatively to quite smoothly rolling prairie lands and is known as the Fort Worth Prairie, while the southern part of the Grand Prairie, from Williamson County north to the Brazos River is called the Lampasas Cut Plain. The latter region is so named on account of the number of large plateau remnants of the old original limestone plateau which rise as buttes or mesas several hundred feet above the surrounding plains.

Small areas of these old limestone plateau remnants in Nolan, Callahan, Taylor, and Coleman counties mark all that is left of the original plateau and these, occurring as they do along the drainage divide between the Brazos and Colorado rivers, are called the Callahan Divide.

Thus the Edwards and Stockton plateaus, the Lampasas Cut Plain, the Fort Worth Prairie and the Callahan Divide are the main subdivisions of the Limestone region of Texas which at one time covered a much larger portion of the State as a high plateau.

The limestone soils are for the most part shallow or stony, while the surface is often hilly and steeply sloping with many areas throughout consisting of land too rough and stony for cultivation, which is classed as Rough Stony land. The largest areas of comparatively smooth lands of these regions occur on the Fort Worth Prairie reaching from the Red to the

Brazos River. Here the Denton soils are extensively developed. These are brown surface soils underlaid by brown to reddish-brown or yellowish-brown subsoils. The limestone rocks lie at a depth of a few inches to two or three feet in many places. When not too shallow or stony, these soils are utilized for growing wheat, oats, cotton, corn, and forage crops, consisting of sorghums. Associated with the Denton there are in places considerable areas of the San Saba soils which consist of dark brown to black surface soils with yellow to brown subsoils. In many places the limestone occurs under these soils from a few inches to two or three feet below the surface. The San Saba soils are utilized for the same crops as the Denton, and are slightly more productive when climatic conditions are equally favorable. On the surface the San Saba resemble the Houston soils of the Black Prairie region. The Crawford are red or reddish-brown surface soils with red subsoils. These soils are not deep, the limestone being near the surface in many places. At the border of the Grand Prairie in northern Texas there are some areas of the Durant soils. These are non-calcareous, being derived, in part, at least, from the adjacent non-calcareous formations of the Cross Timbers regions. The Durant soils are brown on the surface with red mottled subsoils. These are often characterized by the presence of ferruginous sandstone fragments over the surface and throughout the soils and subsoil. These are quite productive soils.

The southern part of the Grand Prairie, the Lam-

pasas Cut Plain, has a larger percentage of Rough Stony land and stony soils than the northern part, the Fort Worth Prairie. Here the walls of the minor plateaus are steep, rough, and stony, while below the rolling plain consists largely of soils of the Denton, San Saba, and Crawford series. In addition to these there are white to gray limey soils, mostly stony or mixed with fine limestone fragments, which are the Brackett soils. These are of low agricultural value and are utilized mainly, with the Rough Stony land, for grazing. The smoother areas of the Grand Prairie are covered with a heavy growth of mesquite and other grasses, while some few mesquite trees occur in places.

The Edwards and Stockton plateau region of limestone soils is utilized mainly for cattle, sheep, and goat raising. The soils here are also mainly of the Denton, San Saba, Crawford, and Brackett series and Rough Stony land. The stony types of these soils predominate over the region, though many areas free of stones may be cultivated easily. Much of the land of this region is covered with live oak and other small trees of a shrub character. The rough stony areas have in places a considerable growth of cedar (juniper). The native grasses are abundant and nutritious, mesquite grass being the most valuable. A scattering growth of mesquite trees is also found in many places. On the whole, then, the main soils of the Limestone region comprise the Denton, San Saba, Crawford, and Brackett series, and Rough Stony land. The fine earth materials of the soils

are here mostly heavy textured, the clay soils predominating. Many large areas consist of more or less stony soil types which could be cultivated only with difficulty. On the Fort Worth Prairie the Denton, San Saba, and Durant soils predominate and consist largely of clay soils, being of the shallow phase in many places.

These same soils occur largely in the Lampasas Cut Plain with some of the Brackett soils and more of the Rough Stony land than on the Fort Worth Prairie. On the Edwards and Stockton plateaus the soils are mainly the Brackett, Crawford, Denton, and San Saba stony types with considerable Rough Stony land. The latter, in fact, predominates in some sections. While the clay soils of these series are developed to some extent in the plateau regions, the stony clays are more extensive.

The largest percentage of cultivable land in this region lies on the Fort Worth Prairie, the next largest percentage occurring within the Lampasas Cut Plain.

In these sections a large amount of farming is done without irrigation, cotton, corn, wheat, oats, and the sorghums being the main crops. Some areas are also cultivated within the Edwards and Stockton plateau region, but crops here are more uncertain on account of droughty conditions.

All of the Limestone region lies within the semiarid part of Texas, but in the eastern portion (Grand Prairie) where the soils that are well suited to cultivation are more extensive, the rainfall is considerably

greater than in the western part or that section occupied by the Edwards and Stockton plateaus. Naturally this is true as the rainfall decreases to the west and the Stockton Plateau, which lies on the extreme west of the region, comes within the arid part of the State where the rainfall is very light. During a number of years there may be sufficient rainfall to produce very good yields in the Grand Prairie or even in parts of the Edwards Plateau, but these are almost certain to be succeeded by years of very scant rainfall and extremely droughty conditions. This climatic condition is especially difficult to overcome on account of the shallow soils over much of the region, as no good reserve of soil-moisture can be accumulated in the shallow soils.

The grain sorghums constitute the most certain crops and, as these do well even under droughty conditions, the region is well suited to stock-farming in many places. While the eastern portion of the Limestone region is well settled and is considerably farmed, there is also a large amount of stock-farming and ranching. The Plateau regions are used principally for raising cattle, sheep, and goats and are excellently suitable for this purpose.

In some parts of western Texas, near or within the Limestone region, there are some large areas of soils that owe their origin to the deposition of valley-filled soil material washed from the denuded areas of the limestone soils or from other sources. These are mainly the Abilene, Miles, and Simmons soils. The Abilene are calcareous brown soils with brown or

reddish-brown to yellowish-brown subsoils. The Miles soils are not calcareous, as a rule. These are red to reddish-brown with red subsoils. The Simmons soils are dark brown to black with brown to black subsoils. The soils of these three series are often underlaid by rounded waterworn gravel which is frequently cemented into a hard conglomerate.

All of these soils are quite productive when moisture conditions are favorable and are used largely for the production of corn, cotton, wheat, oats, and the sorghums. These are prairie soils with a scant thin growth of mesquite trees, or in some places oak trees. Large areas of these soils occur in Nolan, Taylor, Callahan, Coleman, Runnels, and other counties in the region of the Callahan Divide, as well as on old stream terraces above the larger stream bottoms in many sections of western Texas.

No large areas of bottom-land alluvial soils are found in the Limestone region. Some alluvial soils do occur, however, along the streams. These are usually dark in color and are highly calcareous. These are the Frio soils which are formed by the deposition of sediments washed mainly from the soils of the Limestone region. The alluvial soils along the Colorado and Brazos rivers which flow through this region are mainly the Miller series which are red to chocolate or reddish-brown in color. The transported soils of these river "bottoms" are among the most fertile in the State.

WESTERN CROSS TIMBERS AND ASSOCIATED CARBONIFEROUS FORMATIONS

The Western Cross Timbers is the name given to a strip of sandy land in north Texas which is covered principally with a forest growth of post and black jack oak. This strip of country reaches southward from the Red River in an irregular line through a number of counties and reaches its southern limit approximately along the Colorado River near Burnet County. It parallels the Eastern Cross Timbers approximately, with the Grand Prairie lying between the two timbered regions.

The Western Cross Timbers is a rolling to hilly country several hundred to 1,000 or more feet above sea level. Immediately to the west of the Western Cross Timbers is an area including several counties in which the soils and vegetation are quite similar. This is the area of Carboniferous formations which, on weathering, give the same or approximately the same soils as are found in the Western Cross Timbers. This general region also includes a number of small prairies of dark soils with a growth of mesquite trees, and these are Denton, San Saba, and other soils.

The main soils of the region are derived from the weathering of marine sediments, some consolidated, although the true Western Cross Timbers belt comprises some non-calcareous marine sediments of the Lower Cretaceous age.

The principal soils of the Western Cross Timbers

and associated areas to the west are the Windthorst, which are brown to gray soils with heavy red clay subsoils. Much of the land in this region is too stony and rough for cultivation, though many areas are sufficiently smooth to enable ready cultivation. The Windthorst fine sandy loam is the main cultivable soil type of the region, although in some places the stony fine sandy loam, which is also extensive, may be cultivated.

Cotton, corn, and forage plants are the crops grown chiefly in this region.

The region lies in the semi-arid section of the State where rainfall is not always adequate, but the soils produce fair crops when moisture conditions are favorable.

NORTHERN CENTRAL PLAINS

In northern Texas just west of the Carboniferous formations is a rolling prairie plain covering a large section of the State. This region is characterized by reddish soils in many places and these constitute a very noticeable feature of that part of Texas. This region is often called the "Red Plains" or "Red Prairies of western Texas." The Northern Central Plains region lies from 1,500 to 2,500 feet above sea level approximately, while the surface is gently undulating to rolling over large areas, but hilly and with rough eroded places in some sections. The greater portion of this considerable region is suitable for cultivation, though lying within the semi-arid section where droughts sometimes occur. The coun-

try is fairly well settled and farmed, except in some sections, some distance usually from towns or railroads. The unsettled areas where population is scant continue to be extensively utilized for cattle ranching.

While this is a prairie country, there are in most places a sparse to moderately thick growth of mesquite trees. The native grasses are valuable and consist largely of gramma and buffalo-grasses.

The crops produced are cotton, with some corn, wheat, and oats. A very important crop is the grain sorghums which are universally grown. The grain sorghums are the most certain crop in dry seasons. The soils are productive and produce good yields when moisture conditions are favorable. The region is well suited to stock-farming which is carried on to a considerable extent.

The soils are derived from the weathering of the shales, sandstones, and clays of the Permian Red Beds. They are mostly deep and calcareous, and when not protected are rather susceptible to exhaustive erosion.

The main soils of the region are the Vernon which are brown, reddish-brown, red, or chocolate colored soils with red subsoils. The Kirkland are also quite extensive, consisting of dark colored brown or black soils with brown or yellow subsoils.

In the western and southern part of this region are considerable areas of the Miles and Abilene soils, as well as some others.

The soils of the region range in texture from sands

to clays but probably the highest percentage of the land consists of fine sandy loams and loams.

No very large areas of alluvial soils occur in this region, though many narrow strips are found along the larger strips. These soils are chocolate, brown or reddish and are chiefly the Miller series.

THE HIGH PLAINS (LLANO ESTACADO)

A very large part of northwest Texas lies on the High Plains, sometimes known as the Llano Estacado or Staked Plains. This is a vast region of many thousand square miles and includes approximately forty counties. It is the southerly extension of the Great Plains region of the western United States. The elevation of the High Plains ranges from about 2,500 feet in the southern part to more than 4,000 feet above sea level in the northern part. The surface is level to the eye and only a few shallow dry stream beds, or "draws," cross the plains. The Canadian River cuts through the northern part in a deep rather rough valley, while the eastern side of the border is marked by a rather steep and rough escarpment which leads down to the northern Central Plains several hundred feet lower. This border is cut into by a number of streams which in several places have carved deep rough canyon-like valleys several miles into the interior of the High Plains. The process of erosion is constantly wearing away the eastern border escarpment and has produced a very irregular but sharply defined boundary. Thus the

High Plains constitute a high plateau. No trees grow, except those planted, and a heavy growth of native grasses makes a valuable pasturage for stock. For many years this has been a favored ranching section, and is still utilized largely for the purpose. Within the past twenty years, however, a large amount of the land has been placed in cultivation, mainly near the railroads and towns, but often far from railroads.

Farming has been successfully carried on in the years when the rainfall has been favorable. Being in the semi-arid part of the State the rainfall is not always sufficient, though in many years rainfall is abundant and large yields of crops are secured.

Most of the farming is done by the so-called dry-farming method, although in some sections around Hereford, Muleshoe, Plainview and other localities some irrigation is being done by pumping water from wells. The water of the High Plains is, as a rule, of excellent quality, though in many places is too deep to allow profitable irrigation for the production of the general farm crops. Excellent yields of crops have been secured under irrigation.

The main crops grown on the High Plains are the grain sorghums, cotton, wheat, Sudan-grass, oats, and various other small grains. Stock-farming has proved quite successful when sufficiently large areas are utilized for the purpose. Considerable cattle ranching is still done.

The soils of the High Plains represent old sediments of Tertiary time. At depths of two or three

feet over much of the region a whitish calcareous deposit has been formed by accumulation from soil-water as it rose to the surface in the process of evaporation. This deposit is termed "Caliche" and on exposure to the air it hardens into what seems to be limestone. This is the origin of the most of the rocky material on the slopes of the eastern escarpment of the plains.

The surface of the High Plains is marked by numerous small shallow lake-beds termed "playa" lakes which contain water only during rainy seasons. Much of the surface drainage water of the region runs into these lakes, though the headwaters of some of the large Texas rivers, the Brazos, Red and Colorado, have their origin in the shallow draws which cross the region.

The soils of the High Plains are mainly Amarillo and Richfield. Of these, the Amarillo are the most extensive. The Amarillo soils are brown or reddish-brown in color and are underlaid by subsoils of red, reddish-brown or pinkish material. Considerable lime occurs in the lower subsoils. There are thousands of square miles of one soil type, the Amarillo clay loam, on the High Plains. The Richfield soils are dark colored with brown or gray subsoils. These are more poorly drained than the Amarillo soils as they occupy slightly depressed areas. The Richfield clay loams are the main types of this soil series.

In the northern part of the High Plains the soils are mainly clay loams. Here cotton is not grown and the grain sorghums, wheat, and other small

grains are extensively produced. In the South Plains, from Hale County southward, cotton is grown largely and not so much wheat, though the grain sorghums are the most important crop. On the southern High Plains on the western side adjacent to New Mexico there are a number of areas several miles wide of loose deep sand which has been blown into numerous dune-like areas. This soil is utilized only for grazing. A small scrubby oak (shin oak) grows in places and in some adjacent sandy soils. In this section a number of the lighter textured Amarillo soils are found.

A number of large salt lakes are situated on the High Plains. These are dry most of the time, the beds being covered with an incrustation of whitish salts.

THE TRANS-PECOS REGION

There is a large region west of the Pecos River in the extreme western part of the State where arid conditions prevail, the rainfall being very slight. This region, comprising mountains and rough hills with flat plains between, is called Trans-Pecos Texas. Some of the mountains are 4,000 to 5,000 feet above sea level, while the plains below are 3,000 feet or more above sea level.

As already described under the head of the Limestone region, the southeastern part of the Trans-Pecos region is occupied by the Stockton Plateau with rough stony lands and soils of the Brackett and other series of soil.

The mountains of the Trans-Pecos Texas are rough and stony, consisting of rocks of various old geological formations, and the land is suitable only for stock-grazing. The level plains of this region consist largely of soils formed by valley-filled material washed from the eroded mountain lands and other higher areas. These soils often contain large amounts of salts more or less deleterious to plant growth, although much of the salt material is frequently gypsum which is less harmful to plants than many other kinds of salts.

Dry-farming in this region is not successful and only in certain sections is irrigation possible. In Reeves, Ward, and some other counties some land is irrigated from the Pecos River, and from wells. Considerable areas are irrigated from Toyah Creek in Reeves County. The main crops grown under irrigation are cotton, alfalfa, and some forage plants.

Only a very small acreage is devoted to farming in the Trans-Pecos region, the land being mostly utilized for cattle-ranching purposes.

The soils of the level plains portion of the region have been studied only in the eastern part of Trans-Pecos Texas. Here they are mainly chocolate-colored and brown, ranging in texture from gravelly to clay soils. Little is known of the soils in many sections of the region, as arid conditions have prevented the agricultural development of this country to a considerable degree. Some of the alluvial and valley soils are very productive under irrigation, as is noted along the Pecos River and Toyah Creek.

The plains of the region are prairies with a thin growth of grasses and many kinds of thorny shrubs, yucca and cacti.

THE CENTRAL MINERAL REGION

There is a small area in central Texas geologically known as the Central Mineral region, often called the Llano-Burnet region, where there are a number of soils differing considerably from those of the surrounding lands.

This region comprises nearly all of Llano County with portions of the adjacent counties.

The topography of this country ranges from level to rolling with extensive areas of rough broken lands and stony hills and slopes. The elevation is 800 to 1,300 feet above sea level.

The soils are residual in origin, being derived from the weathering of granites, schists, gneisses, and sandstones.

The Tishemingo soils found here are reddish with subsoils of red, yellow, brown, and mottled brown and gray. The Lancaster soils are grayish to reddish-brown underlaid by yellow or mottled yellow and gray subsoils, and the underlying sandstone occurs at comparatively shallow depth. Other soils, the Pontotoc, have bright red surface soils with red subsoils. The sandstone lies near the surface of the Pontotoc soils. Most of the soils of this region are sandy in texture and in many places stony material is abundant.

The native vegetation consists largely of a small

timber growth of post oak, black jack oak and mesquite.

The smoother and deeper soils, when comparatively free of stony material, are fairly productive and are cultivated to some extent. Cotton, corn, and forage crops are grown.

The soils that have been described may be classified as residual or transported, depending on their origins. The residual soils of Texas trace their origin to geologic formations from which they have been derived. Transported soils are formed of materials carried to their present position by water, ice, or wind. The soils of the Black Prairie region are derived from the rocks of the upper Cretaceous. The soils of the Grand Prairie are derived from the lower Cretaceous. The soils of the plains section of the State are derived from sediments of an ancient lake of the Neocene period. Crop production, therefore, is dependent on the interrelations of geological formations and soil products.

The following tabulation roughly summarizes the soils of Texas with their characteristic names and their more typical agricultural uses:

Region	*Main Soils*	*Agriculture*
1. High Plains	Amarillo soils	Small grains (in northern plains)
	Richfield soils	Cotton (in southern plains)
		Grain sorghums, sorgo, and other forage crops
2. Edwards Plateau	Large areas	Cattle, sheep, goats
	Rough stony lands	Little farming
3. Trans-Pecos region	Mountains and desert plains	Cattle raising
	Alkali	Farming where irrigation is possible
4. Rolling Plains	Vernon soils	Small grains, cattle raising, cotton, grain, sorghums, sorgo, and other forage crops
	Miles soils	
	Foard soils	
	Abilene soils	
	Simmons soils	
5. Rolling Prairies and Timber Mixed	Windthorst soils	Cotton, small grains, vegetables, fruit
	Various sandy and heavy soils	
6. Western Cross Timbers	Windthorst and various sandy soils	Cotton, vegetables, fruits
7. Rio Grande Plain	Brennan soils	Cotton, vegetables
	Duval soils	Fruit
	Laredo soils	Cattle raising
	Houston soils	
8. Coast Prairie	Victoria soils	Cotton, fruit, vegetables, cattle raising

CHAPTER III

OTHER NATURAL RESOURCES OF TEXAS

Texas is rich in a variety of natural resources that have contributed to the wealth of the State and influenced its agricultural development. The vast area of Texas and the variety of topography, geological formations, soil types, and climate have been responsible for the great abundance and variety of natural resources. The distribution of these resources has exerted a large influence on the distribution of the population and, to some extent, has influenced the agricultural and industrial development of the State.

THE FORESTS

The forest resources of Texas have been very extensive and of great importance. Originally there were in east Texas approximately 18,000,000 acres of forest, consisting of about 12,000,000 acres of pine and 6,000,000 acres of hardwood, and mixed stands of hardwood and pine. Today there remain only about 1,750,000 acres of virgin pine timber and over large areas the best of the hardwood timber has been removed.

The most important forest area is confined to the

eastern part of the State. The forest resources decrease rapidly from about the ninety-seventh meridian westward. East Texas may be divided conveniently into three distinct forest areas, as follows: (1) the loblolly pine region, (2) the long-leaf pine district, and (3) the short-leaf pine region. These will be discussed in the order named.

The loblolly pine region occupies probably 6,000 or 7,000 square miles between the long-leaf district and the treeless grass-covered portion of the coast prairie which extends inland from twenty-five to fifty miles from the Gulf. East and west the loblolly pine extends from the Sabine nearly to the Brazos, occupying the interior portions of the coastal prairie and changing on the north to the long-leaf and short-leaf pine, as the coastal prairie passes into the drier more porous soils farther inland. Scattered trees or groups of loblolly pines are found as far south and west as Brazoria County and small units of this species are located in Fayette and Bastrop counties where they are growing under quite different conditions.

The southern portion of the loblolly pine region consists of alternating belts of open prairie and timber land. Near the Gulf the timber is entirely lacking and only an expanse of poorly drained sea marsh and grass prairie exists. Farther inland patches of timber begin to appear along the streams or on natural elevations of sandy porous soils. These patches become larger farther north, forming the loblolly and hardwood type which has been largely cut over and broken up into farms.

The long-leaf pine region occupies some 5,000 square miles of the east Texas timber belt. It lies north of the loblolly pine country and extends from the Sabine to the Trinity River, where the loblolly and short-leaf pine regions meet to form its western boundary. This region includes the center of the lumber and turpentine industries of the State. The altitude is above that of the loblolly pine, ranging from 100 to 300 feet, and the country is rougher and better drained. Sandy ridges and deep open-textured soils are characteristic. Long-leaf pine is able to thrust its tap-root deep into the soil, and in a measure is independent of dry surface conditions. Often one finds loblolly pines and hardwoods in the draws and bottoms of the long-leaf region.

The area included within the short-leaf section covers all the northeastern counties of Texas as far south as the long-leaf and loblolly pine regions and as far west as a line drawn from the western part of Red River County through Franklin, Wood, Smith, Henderson, and Anderson counties to the Trinity River, continuing southward along this river and meeting the loblolly region in Madison County. It is the largest of the yellow pine subdivisions, being 25,000 square miles or more in area, and is well developed agriculturally. The great virgin short-leaf pine forests have been practically cut over and small mills with a few larger ones are now operating in second growth timber, which has attained merchantable size since the first cuttings were made.

In addition to the pine forests, east Texas has ex-

PLATE III. Above, a type of irrigation ditch found in the rice section of south Texas. Below, a concrete irrigation ditch in the lower Rio Grande Valley which conserves the water supply and insures economy of operation.

tensive hardwood areas. The rivers and larger creeks have worn broad channels, rich in alluvial deposits. These bottom lands intersect the uplands of the shortleaf, long-leaf, and loblolly pine regions and along the larger rivers are frequently five miles or more in width. Some of these bottom lands have been cleared for cultivation. However, they were once, and in most of east Texas counties are still, covered with hardwood forests. Nearly all of the species common to the Atlantic states are found in this forest type.

The removal of timber from bottom-land forests has been a constant process extending over many years. The more valuable specimens of white, overcup, burr and cow oaks, white and green ash, black walnut, hickory, cottonwood, and basswood have been cut. There are an abundance of young growth of these species and vast quantities of timber of large size among the species hitherto considered of little value, such as red, black, willow and water oaks, some species of hickory, sweet, black and tupelo gums, sycamore, elm, magnolia, holly, maple and others. Stave cutters have sought the white oaks, while other valuable species have gone for veneer stock, boxes, headings, furniture, and a multitude of other products. The rapid development of small wood-using industries, particularly in northeast Texas, has made it profitable to haul these hardwoods long distances from the bottoms to the mills.

A limited area of swamp forests is found in the poorly drained Coastal Plain within the loblolly pine

region. Along all the streams of the Coast lowlands from the Trinity River eastward, the forests show, to a greater or less degree, the characteristics of this type. These areas are most abundant along the lower Neches and Sabine rivers. Bald cypress and tupelo gum are the principal species, and with them water oak, water ash, swamp maple, magnolia, black gum, swamp hickory, and sweet gum.

The east Texas commercial timber belt no longer represents a great area of timbered lands, as the name implies. It is rather a combined agricultural, grazing, and forest region, portions of which still contain an abundance of timber and maintain large forest industries. The counties which comprise this region supported an agricultural population before the lumber industry invaded the State. Over large parts of the district lumbering has reached its zenith and declined. In other parts it is now at its maximum and overshadows all other interests. Of forty eastern counties, with a total area of nearly 21,000,000 acres, one-third is improved agricultural land and the balance is made up of virgin, culled and second-growth forests, waste and overflowed lands.

Agriculture is well advanced in the northeastern counties, where lumbering on a large scale first began and has since declined, and has been most delayed in those counties in which lumbering still dominates. The time is approaching when the remaining large timber tracts will be cut over. There is every reason to hope and expect that large bodies of cut-over lands will be divided into farms and the agricul-

tural soils tilled. In fact, most woodland areas in northeast Texas have become part of farms and should be protected and handled so as to produce fuel, posts, lumber, and other forest products for home use and for sale. Increases in stumpage values are constantly taking place and, when the large timber holdings are gone, products from farm woodlots and small timber holdings will have a value comparable with forest products in agricultural regions of other sections of the United States which are high today. The variety of forest products has already increased and stumpage values are relatively high in many of the best agricultural counties of northeastern Texas where the lumber industry on a large scale has disappeared. Hardwoods hitherto not exploited are coming into the market where once only pine was manufactured. Forest products in a variety of forms are being utilized along with the advance in agriculture and the more intensive use of land.

The main body of post oak woodlands occupies the section between the western limit of the short-leaf and loblolly pine regions and the Black Prairie belt of east-central Texas. Southwestward the post oak country extends in a narrowing belt, nearly to the Rio Grande River. It occupies the western and southwestern portions of the lignitic geological formation, the eastern portion of which lies within the pine regions. Decreasing rainfall and the changing physical condition of the soils are primarily responsible for the falling off of pine and the general character of the existing forests. Toward the Rio Grande tree

growth constantly becomes more open and dwarfed and the Atlantic species, one by one, give way to dry-land species extending northward from Mexico. Outside of the main body of post oaks, conditions adaptable to this forest type are found in the Eastern and Western Cross Timbers, and the granitic area of the Central Mineral region. Post oak forests in irregular bodies occur from the Red River to the latter region wherever sandy or gravelly soils prevail. The terraces along the Colorado River near Austin are also occupied by the post oak type.

Next to the east Texas commercial forests and the post oak region, the cedar brake area is the most important timber country in Texas. Cedar is widely distributed over most of the State, but it is most abundant in the limestone formations west of San Antonio and from San Antonio northward through the limestone hills to Lampasas. Smaller areas of cedar occur extensively over adjacent portions of central Texas. In the Edwards Plateau district it is the principal species, but as the Plateau merges into the central denuded region to the north and west, cedar loses its prominence. In the brakes of the plains it is again in evidence but is usually dwarfed and scrubby in growth and appearance.

Although posts, poles and building materials to the value of over $1,000,000 are cut annually from the cedar forests, it is believed that the cedar brake area and the hardwood timber of central Texas are of chief importance as a protective forest, beneficially affecting the stream flow of such rivers as the Colo-

rado, Frio, Guadalupe, and Brazos, which have their source or flow through this region. The forests constitute an important factor in preventing erosion of the thin limestone soil and lessening the run-off of surface waters. Consequently, the vast amount of precipitation is absorbed by the soil and eventually reappears from springs and other underground sources.

In central Texas there is also an extension of the east bottom-land forests. The bottoms of the Navasota and Brazos rivers mark the west limits of a number of species of commercial importance farther east. In the west extension of this bottom-land type the elms, hackberry, pecan, red burr and live oaks, sycamore, and other wood are the principal species. Pecan culture becomes an important industry. Land owners have learned to spare the pecan tree, not only because of the value of the native nuts, but also for utilization for top-pruning and grafting of improved varieties.

The mesquite deserves special mention in a description of the forests of Texas. A more or less scattered growth of mesquite is found over practically the entire State, except the Great Plains proper, in northwest Texas and that portion of eastern Texas lying east of the lower Brazos River, the Navasota River, and the upper reaches of the Trinity River. The heaviest stands and the largest mesquite timber are in the territory south of the Edwards Plateau to the lower Rio Grande and to the north of the Plateau, through the central denuded region. Under favorable conditions mesquite attains a size suitable

for lumber, railroad ties, and building materials; but in general its growth is scrubby. Mesquite has furnished millions of durable fence posts for Texas ranches. Its ability to produce fence-post material in regions unfavorable to other tree-growth has made it of particular economic value.

A limited amount of forest growth occurs in the Guadalupe, Davis, and Chisos mountains. The principal species are western yellow pine, Douglas fir, limber pine, emory oak, and pinon pine. This timber, because of its dwarfed size, is of very little value for commercial purposes. However, it constitutes a valuable asset in the use of these areas for recreational purposes and as a protective covering on the watersheds of the numerous creeks having their source in these mountains.

In view of the rapid depletion of timber resources, the forest problems of the State warrant serious attention on the part of Texas citizens. In the three forest regions comprising the east Texas timber belt, forests should be renewed on over 4,000,000 acres of cut-over land now devastated and largely non-productive. The office of State Forester, which was created in 1915 and placed under the jurisdiction of the Agricultural and Mechanical College of Texas, has done what it could along this line. Annual grass and forest fires in the cut-over areas have been and are the greatest obstacle in securing another growth of trees. Investigation has shown that fires not only destroy over 92 per cent of the seedling trees, but also retard the growth of such young trees as manage

to keep alive in spite of annual burnings. A campaign of education and fire suppression inaugurated by the State Forester has made conditions favorable for the re-forestation of vast areas of this cut-over land, which has such a low agricultural value that the public will be best served by having it produce another crop of lumber trees. Most of the second growth pine timber is in the short-leaf pine region of northeast Texas and is owned by thousands of farmers. It follows, therefore, that the timber supplies in the future will depend to a marked degree on the proper handling of these farm forests. The farmers of Texas are vitally concerned with the forestry problem, both as the largest consumer of lumber and other wood material and as the owner of vast areas of young timber now approaching merchantable size. Everything possible should be done to encourage the proper management of farm forests, for this practice will be profitable to the farmer himself and will lessen the intensity of the approaching period of timber scarcity, which will be at hand in another decade when the bulk of the remaining virgin timber has been cut.

The timber land in the extensive post oak region is owned exclusively by farmers who annually remove from this area posts, fuel and other wood materials, having the value of approximately $10,000,000.

The cedar brakes in central Texas should be given proper management and protection from fire at an early date. This is also true with respect to other

forest land in central Texas. Due to recent disastrous floods, the problem of flood control has been recognized on all sides as one of the important questions confronting the public. In the opinion of some of the leading newspapers and citizens interested in flood-control work, the flood situation has been aggravated because of excessive removal of forest cover on the watersheds of the streams involved. The reforestation of eroded areas and the protection of existing forests in these regions in relation to flood control should be investigated carefully.

Texas has a vast area naturally devoid of trees in which tree planting by farmers should be encouraged. The lack of trees around the farms and ranches of western Texas is strikingly noticeable to a person accustomed to the wooded sections of the State. Not only do the farm-houses in the Plains region appear desolate, due to the dearth of trees, but actually they lack the comforts of the homes farther east, being exposed to the hot sand-storms of early summer and the blizzards of the winter months. Furthermore, the absence of trees reacts on the crops which are injured by the high drying winds more than would be the case if windbreaks and shelterbelts were planted.

Three general regions are recognized in the treeless section of the State; i.e., the Panhandle above the cap-rock, west Texas below the cap-rock, and the Trans-Pecos country, west of the Pecos River. Below the cap-rock there is a scant growth of cedar on the uplands, while some hackberry, oak, and elm occur

in the draws. The annual rainfall amounts to twenty-two to thirty-two inches and the growing season is relatively long, due to the altitude, which is from 500 to 2,000 feet. The Panhandle country is 2,000 to 4,000 feet high, with a growing season shorter by two or three weeks than below the cap-rock. The average annual rainfall runs from fourteen to twenty-two inches. In the Trans-Pecos country the elevations range between 300 and 6,000 feet, while the rainfall is reduced to between eleven and sixteen inches.

Originally much of this territory was cattle country, but of late years the dry-land farmer has been settling in the former realm of the cow-man. When wet or favorable years occur they make big crops, but on the average they have no more precipitation than they need and even what does occur is partly off-set by hot parching winds which evaporate the moisture in the ground and cause excessive transpiration from the crops. Under these conditions any action which can be taken by the farmer to conserve the available moisture, or to increase it, would be a boon. Judicious planting of windbreaks and shelter-belts helps conserve the soil-moisture of tilled areas by lessening the force of the winds, thereby reducing evaporation both from the ground and growing crops. Windbreaks bordering tilled fields, as well as shelter-belts and groves on the exposed sides of the farmsteads, will not only afford protection, but also produce fuel and post material, products in great demand in west Texas.

A survey of the forestry situation indicates that both public and private action is called for at the earliest possible date to insure the proper management of the remaining forest areas, to secure without delay the renewal of lumber forests on the non-agricultural cut-over areas in east Texas, to stimulate the planting of trees for shelter and the production of posts and other wood material by land owners in the treeless sections of the State, and, in general, to bring about the highest production of those areas which, from the standpoint of public welfare, should be devoted to timber production.

GAME, FISH, AND OYSTERS

The variety of topography, climate, and vegetation, the chief agencies of control in the distribution of animal life, accounts for the number and diversity of the fauna of Texas. When the first explorers and early settlers came to Texas, vast herds of buffalo roamed the prairies. Deer, wolves, bears, turkeys, and quail were found in great numbers and widely distributed over the State. Smaller animals, such as opossums, raccoons, rabbits, foxes, lynx and squirrels, were abundant. At the present time most of the larger animals have completely disappeared from the more thickly settled sections. The American buffalo, or bison, has become practically extinct in Texas since 1880. A few herds, composed of comparatively small numbers, are found on a few ranches, such as the Goodnight Ranch, Goodnight, Texas, in Armstrong County. The Texas, or fan-tailed, deer, a smaller

species of the Virginia deer, is still found in the large pastures of southwest Texas and, in smaller numbers and more widely scattered, in certain forest sections of east Texas. Many of the smaller animals, such as squirrels, raccoons, civet cats, bob cats, coyotes or prairie wolves, and rabbits, are still of considerable numbers, but they are also rapidly disappearing from many sections of the State. Prairie dogs, whose familiar "dog towns" were common on the western plains at an earlier date, are rapidly disappearing through the systematic efforts to destroy them in order to reclaim grazing lands that they made valueless for ranch purposes.

Like other Gulf Coast states, Texas is bountifully supplied with an interesting bird fauna. Much of the bird life along the coast, consisting of ducks and geese, is of a migratory character, but throughout the winter season these birds are in great abundance. The mocking bird, the cardinal or red bird, the field lark or lark sparrow, the mourning dove and the bob white are rather widely distributed from the coast to the Great plains of the Llano Estacado. The bob white and mourning dove are probably more widely distributed than most other varieties and both supply sport for the hunter. Birds that are rarer and less widely distributed are the chaparral bird or road-runner, notable for its swiftness of foot and native in the southwestern part of the State; the snowy heron, along the Gulf coast; and the scissor-tailed fly catcher or Texas bird-of-paradise, notable for its long tail-feathers.

Animals of the reptilian and amphibian classes are native in Texas and include crocodiles, turtles, lizards, and snakes. The alligator is found only in a few rivers in the Coastal region. The turtles are represented by the tortoise, common in central Texas, the snapping and the solf-shelled turtles inhabiting many creeks and small rivers, and the mud turtles in marshes and water holes.

The most familiar lizards of Texas are the common green lizard, the rock lizard of west Texas, and the horned toad, which is well known and widely distributed.

The snakes of Texas are of many kinds and widely distributed. They range from the most harmless to the most poisonous species. The former include the spreading adder, the black snake, the coach-whip, the bull snake, the king and the garter snakes. The poisonous snakes include the copper-head or dry-land moccasin, the water moccasin, the ground rattle-snake, the diamond rattle-snake, the prairie rattle-snake, and the green rattle-snake of the Rio Grande Valley.

The fish resources of Texas are rather abundant, although the absence of large natural lakes limits the number and varieties. The fresh-water streams and lakes near the Gulf Coast are very well supplied with fish. Many of the streams and small lakes contain many species of food value. These include channel cat, chuckle-headed cat, mud cat, black bass, and many other varieties. The bays along the Gulf abound in numerous species of salt-water fish of great

economic importance. As much as 6,057,987 pounds of fish have been caught and marketed in one season along the Texas coast.[1]

The oyster resources of Texas are of great potential importance. While little scientific attention has been given to the development of oyster-beds along the Texas coast, the Game, Fish, and Oyster Commissioner reports the production of 114,729 pounds of oysters in one season. However, there has been a steady decline in the production of oysters in the last few years, due to no systematic effort having been made to develop oyster resources in Texas.

A systematic effort is now being made to conserve the game, fish, and oyster resources. The State has passed laws restricting the hunting season and systematically regulating fishing in the streams and lakes. The Game, Fish, and Oyster Commissioner is not only charged with the responsibility of enforcing the statutes for the protection of game and fish, but he has also been charged by law with the responsibility of systematically propagating fish and game. A fish hatchery has been established at Dallas; and the Commissioner is distributing pheasant eggs, with a view to increasing the number of these birds in the State. This officer has also been instrumental in increasing the number of water fowls, including ducks, geese, swans, and cranes, by shortening the hunting season, by the elimination of spring shooting, the stoppage of night shooting and market hunting, and

[1] See Annual Report of the Game, Fish and Oyster Commissioner of Texas for the fiscal year 1920.

by the limiting of the number of birds that may be shot in one day. It is believed that through systematic effort under the authority of law, the game, fish, and oyster resources of Texas will be multiplied rapidly within the next few years.

MINERAL RESOURCES

The leading mineral resources of Texas in order of value are petroleum, sulfur, coal, and natural gas. The development of these resources in recent years is as interesting as it has been remarkable.

The source of oil and gas is the decomposition of organic matter. Originally all sedimentary rocks probably contained more or less bituminous material from which oil and gas were derived. Sedimentary rocks have always been deposited in waters where animals and plants lived. The extent of bituminous material, of course, has depended on the amount of animal and plant life deposited in sediment. "It has been estimated," says Udden, "that the bituminous material present in the upper four thousand feet of the sedimentary rocks in the western part of Texas is sufficient in quantity to cover the ground with a layer at least one foot in thickness." [1]

The greater part of this bituminous material probably comes from plant rather than animal life. This explains why oil and gas are rarely found in igneous

[1] "Review of the Geology of Texas," by J. A. Udden, C. L. Baker and Emil Bose, Univ. of Texas Bull. (1916), No. 44.

or metamorphic rocks. Udden summarizes the conditions favorable to the production of oil and gas as follows: "(1) The presence of a large body of bituminous rock yielding a source for the oil and gas; (2) structural conditions favorable for accumulation in sufficient quantities to be profitable; (3) storage within reach of the drill in beds of sufficient porosity to yield a profitable supply; (4) the presence of a non-porous cover on the oil or gas-bearing horizon to prevent the escape of the oil and gas to the surface. The following structures are favorable for the accumulation of oil and gas : (1) anticlinal structure and, very rarely, synclinal structure; (2) dome structure; (3) sealed faults; (4) joint cracks; (5) lenticular porous beds occurring in non-porous rocks—accumulations due to thinning or change in texture of the 'sand' in some direction; (6) terrace structures, or local changes in the general dip of the rocks."

That many of the geological formations of Texas conform to these essential conditions is indicated by a review of the geological formations of the State. Profitable supplies of oil and gas have been found in widely distributed areas in certain parts of the Pennsylvanian, in the Cretaceous sediments, in the Tertiary sediments and in one instance (at Thrall) in an altered igneous rock of Cretaceous age.

The oil development of Texas is quite recent. Previous to 1898 the number of barrels produced in Texas was negligible, but the rapidly increasing production in recent years has been phenomenal. In

1919 Texas stood second in the number of barrels of oil marketed in the United States, having been exceeded only by California. The first oil development was at Corsicana in Navarro County. This field produced 1,450 barrels in 1896 and increased to 829,560 barrels in 1900 when oil was discovered at Powell. Since that time oil has been found in succession at Petrolia, in Marion County, in Wichita and Wilbarger counties, at Moran and Strawn, in Coleman County, in Eastland County, in Stephens County, at Desdemona, in Brown County, and at Thrall and Mexia. The first oil discovery along the Gulf Coast region was at Spindletop, near Beaumont, in 1901, and in succession in this section at Sour Lake, Batson, Matagorda Bay, Saratoga, Humble, Dayton, Blue Ridge, Goose Creek, Orange County, Daymond Mound, Hull, Barber's Hill, West Columbia and other places. These fields produced 85,312,000 barrels of oil (forty-two gallons to the barrel), in 1919. While the production is far from uniform in the different fields and many of the older fields have ceased to produce in profitable quantities, there is no likelihood of the total production of the State decreasing in the next few years. In fact, there is every reason to believe that there will be an extension of some of the existing fields and the discovery of new fields that will more than off-set the decline in production in some of the older areas.

The great increase in the production of crude oil in Texas has also been responsible for the rapid multiplication of oil refineries and pipe lines. Texas

leads all other states in the number of refineries and the total output of refined products. The pipe line mileage in the State exceeds 2,000. These pipe lines extend from the Oklahoma and north Texas oil fields to the Gulf ports where several of the largest refineries of the world are located. From the ports along the coast oil products are shipped to every part of the world.

Texas also ranks high as a natural gas-producing state. On the basis of volume produced, Texas ranks seventh or eighth. The volume of natural gas yielded commercially in Texas in 1917 was 17,047,-292,000 cubic feet. Since this time several other important gas fields have been developed, including that of Potter County which is one of the largest fields of the country. There are between 250 and 300 gas-producing wells in the State at the present time, exclusive of oil wells that also produce gas. Natural gas has been supplied to a number of north Texas cities for power, heating, and lighting purposes from the fields of that section. However, several of the most important gas fields of the State are at such great distances from the large commercial centers that it has not been practicable to utilize the natural gas produced for commercial purposes. There is large opportunity in Texas for industrial and commercial enterprises to secure very cheap power by locating contiguous to some of these larger fields where natural gas resources seem to exist in almost exhaustless quantities.

The coal resources of Texas cover a wide area and

comprise one of the greatest natural resources of the State. There are approximately 60,000 square miles of lignite, extending over considerable portions of the State lying east of a more or less regular line extending from the Rio Grande to the Red River, through Austin, Waco, and Dallas. The known area of lignite in the United States is estimated at about 127,000 square miles. The Texas deposit, therefore, is approximately one-half that of the entire nation. The original supply of lignite in this State is estimated at approximately 30,000,000,000 tons and the production to date has exceeded 10,000,000,000 tons.

The production of coal in Texas in 1918, according to a report of the Department of the Interior, was 2,261,135 tons, of which 1,074,183 were bituminous coal and 1,186,952 lignite. The principal bituminous coal areas of Texas are in the counties of Erath, Maverick, Palo Pinto, Webb, Wise, and Young. The principal lignite-producing counties include Bastrop, Henderson, Hopkins, Houston, Leon, Medina, Milam, Robertson, Titus, and Wood. The chief lignite-producing county is Wood, where at Hoyt and Alba, seventy-five miles east of Dallas, the normal production is from 1,000 to 1,500 tons a day.

There are vast quantities of lignite in Texas that cannot be mined profitably at the present time, due to the depth of the veins. The geological distribution of coal, which includes anthracite, true bituminous, and the so-called "brown coals", such as lignite, has been determined rather definitely. The unknown quantity is the economic reachable depths and the

quality and character of the deposit. There is need at the present time for a vertical geological survey of the coal areas of the State. Such a survey would eliminate the present losses and waste in the haphazard methods of missing lignite veins and greatly encourage the development of the industry.

It has been determined by a leading engineering authority that very conservative estimates of the fuel value of the Texas lignite fields tend to show that they contain enough available heat units to supply the whole of Texas with its utmost demand for heat, light and power for the next three or four hundred years. And, besides all this, the residuals—by-products, almost useless as fuel but of great value chemically and in other commercial uses—if properly conserved and used, would have a present value of over a hundred billion dollars.

The most important fact connected with the lignite resources of Texas is that it is to be found in great quantities in the most thickly populated parts of the State and almost adjacent to several of the largest cities. This insures for both the city and the country an actual and potential supply of cheap light, heat and power for all industrial and commercial uses for a long period of time.

Sulfur is being produced at the present time by nine mines, located in the states of Louisiana, Wyoming, California and Colorado, two in Nevada and three in Texas. The two largest producers of sulfur are the Union Sulphur Company whose mine is at Sulphur, Calcasieu Parish, Louisiana, and the Free-

port Sulphur Company whose mine is near Freeport, Brazoria County, Texas. These two companies furnish about 99 per cent of the sulfur produced in the United States. Sulfur is also found in Culberson and Pecos counties. The sulfur deposits of Culberson County occur in the central and eastern parts. In this district native sulfur is found in a gypseous limestone and workable deposits appear very near the surface. The commercial value of sulfur in this section, however, has not been of great importance up to this time.

The sulfur beds of Brazoria County have become of great commercial value. These beds lie approximately 1,000 feet below the surface at Freeport, at the mouth of the Brazos River, and a large plant for the production of sulfur, with a capacity of approximately 120,000 tons a year, is in operation at that place. The method of extraction is that of forcing super-heated water through pipes into the deposit, sustaining and dissolving the sulfur, then pumping the material back and allowing the sulfur to deposit in open-air bins. By this method a pure sulfur is attained which is in great demand in connection with the manufacture of commercial sulfuric acid, powder, sulfite for bleaching wood pulp, and other purposes.

Gold, silver, copper, lead, zinc, and quicksilver are found in varying quantities in Texas. The Presidio Silver Mine, at Shafter, is equipped with a large cyanidation mill and the output from this mill represents the greater part of the State's production of

silver. The Metals Products Association has constructed at Alpine, in Brewster County, a fifty-ton smelter for the treatment of lead-silver ores.

Copper ore has been produced in good quantities from the mines in the Quitman Mountains, in El Paso County, and the Sierra Diablo Mountains, in Culberson County. The copper resources of the Trans-Pecos country are thought to be worthy of a much larger development than has yet been undertaken. Other sources of copper ore occur in the Permian formation in the counties of Foard, Knox, King, Stonewall, Haskell, and Jones. Copper ores are found in a number of other places in the State, but up to the present time the proportion of copper has not been sufficient to make it economically profitable to engage in its production. The amount of copper credited to Texas since 1906 is approximately 100,000 pounds.

The gold ores of Texas appear sparingly in certain silver-lead ores in the Trans-Pecos region; in combination with quicksilver ores in Brewster County; in quartz veins in Blanco, Burnett, Gillespie, Llano, and Mason counties. It is also found in some cretaceous limestone in Tom Green and Williamson counties, in black sands in Llano County and in the sands of the Colorado River near Austin. However, workable gold ores have not been discovered in sufficient quantities to make them of great commercial importance.

Texas has been a very small producer of lead. The lead that has been produced has been derived from

concentration of ores at Shafter and in the Quitman Mountains, together with unimportant shipments of ore from Brewster County. There are other ores containing lead in certain parts of the State that may become profitable in time. The most encouraging outlook for lead ores is in the Quitman Mountains.

Zinc, in combination with other metals, is found in the extreme western part of the State. In the form of zinc carbonite it is present in Presidio County, two miles west of Shafter, where it is reported to exist in considerable quantities. There is also some of this ore in Brewster County. Zincblende (sulfide of zinc) occurs in Culberson County; in association with silver, lead and copper ores in the Quitman Mountains; and in a few other places in this locality.

CHAPTER IV

HISTORY OF AGRICULTURE IN TEXAS

Agriculture in Texas antedated the beginning of recorded history. When the first European settlers reached Texas soil, they found several Indian tribes, particularly those dwelling in the regions near the Gulf Coast, practicing a crude system of agriculture. However, early history of agriculture in Texas can probably best be traced in connection with Spanish, French, and English exploration and colonization.

The history of Texas may begin appropriately with the landing of René Robert Cavalier de la Salle on the west side of Matagorda Bay on the eighteenth day of February, 1685. Spanish explorers had taken possession of Mexico as early as 1519. Soon after this time a large party of emigrants on their way to Mexico was shipwrecked on an island near the Texas coast. Many of these Spaniards were drowned, while others very soon lost their lives, due to exposure and hardships. Among the survivals was a young man by the name of Cabeza de Vaca who was at first made a slave by the Indians, but who was later released and became a trader among the savage tribes. After six years, accompanied by three of his companions, he succeeded in reaching Mexico. Cabeza de Vaca promptly corroborated the numerous exaggerated re-

ports of the natural resources of Texas that had already reached the Spaniards in Mexico. His glowing accounts of the country resulted in Coronado's leading an exposition into Texas. Captain Coronado traveled for several months through parts of west Texas, but instead of discovering rich cities and great natural wealth he only found a few Indian villages and a country of scanty resources. The significance of Coronado's visit was that he introduced sheep and horses among the Pueblo Indians with whom he came in contact in those regions. This seems to have marked the beginning of a more or less frequent contact between the Indian tribes of west Texas and Spanish settlers in Mexico, for it is recorded that Coronado visited Sante Fé in 1582.

It was exactly a hundred years later that La Salle with a small band of Indians and travelers discovered the mouth of the Mississippi River and laid claim to the territory drained by it for the kingdom of France. He returned to France and reported his discoveries to Louis XIV. Permission was granted for La Salle to return for the purpose of establishing a permanent settlement near the mouth of the Mississippi River. He began his journey with four ships. He had on board a number of adventurous soldiers, several missionaries, a few carpenters, mechanics and blacksmiths, and a number of farmers. Some of these were accompanied by their families. Many misfortunes were experienced during the journey across the ocean. Dissensions arose between La Salle and his companions that threatened the success of the undertak-

ing. Near the coast of San Domingo a storm separated the vessels and one of them (the St. Francis) was captured by the Spanish. La Salle was sick for three weeks which delayed the departure from Petit Gouave, the port in which they had entered as a protection from the storm. It was here that the expedition renewed the store of supplies and acquired a number of domestic animals. They sailed from this port on November 25, 1684, and passing around the southern shores of Cuba, landed at the Isle of Pines where they remained for three days. After leaving this place the expedition experienced adverse winds that drove them far off their course. On the first of July, 1685, LaSalle landed on the Gulf Coast, perhaps just east of the mouth of the Sabine River, but being unable to secure satisfactory information from the Indians he cast anchor and proceeded westward until he arrived at Matagorda Bay on February 18, 1685, where the first landing was made. La Salle continued his journey up the bay and entered the mouth of the river which he named Les Vaches (The Cows), on account of the number of buffalos he found there, and landed on the left bank of the stream about six miles above its mouth.

He took possession of the country in the name of Louis XIV of France and built a church and a fort. La Salle called the place Fort Saint Louis. Crops were planted and provision was made for the care of animals and fowls. Thus was established the first Texas settlement and the first efforts by Europeans to farm on Texas soil.

AGRICULTURE OF THE INDIANS

The economic progress of the American Indians has been far from uniform. The stages of economic development are supposed to begin with the frugivorous and pass in succession to the hunting, the pastoral, and the agricultural. The Indian tribes of America revealed great differences in the stages of advancement. This is partially explained by geographic environment and the varying nature of the crises and reaccommodations to which they were subjected.

Prescott tells us in his Conquest of Mexico that "Husbandry, to a limited extent indeed, was practiced by most of the rude tribes of North America. Wherever a natural opening in the forests, or a rich strip of interval met their eyes, or a green slope was found along the river they planted it with beans and Indian corn."[1] However, according to this writer, the Aztec Indians were far in advance of their red-skin brothers living to the north of them. All the inhabitants, except the soldiers and nobles, were found to cultivate the soil when Cortez came in contact with them in 1519. The farm labor was performed by the men, while the women did only the lighter work, such as sowing the seed and husking the corn. In this respect they were in marked contrast to other tribes of the continent.

Prescott states that the Aztec Indians allowed their land to lie fallow when the fertility was partially ex-

[1] Volume I, p. 110.

hausted. They built canals and practiced a partial system of irrigation. They even built granaries of rather permanent construction for storing their grain.

In the Conquest of Peru Prescott calls attention to the fact that the Peruvians "practiced agriculture in an effective way against unusual obstacles of nature. They were well advanced in dry land farming and irrigation. They also developed great ingenuity in the adaptation of their crops to soil and climatic conditions. But their instruments of cultivation were crude and they had no draught animals for farm use." [1] None of the Indian tribes that La Salle found in Texas showed anything like the agricultural knowledge that was displayed by the Aztecs and Peruvians when Pizarro and Cortez came in contact with them. This is partially explained by the fact that La Salle's Indian neighbors were few in number and rather widely scattered. Most of these Indian tribes lived in villages from which they roamed the prairies and forests, hunting and fishing, or thieving, or in making war on their neighbors. However, there were some that were more inclined to peaceful pursuits. These tribes practiced a crude agriculture. They made their own clothing and set up some form of government. In general, the tribes living in the Gulf Coast section of the State were more peaceful than those tribes that lived on the plains and near the mountainous sources of the main water courses. The white settlers were not long in learning the char-

[1] Volume I, pp. 138-145.

acteristic differences between the several tribes of Indians.

The Pueblo Indians were the most advanced in civilization of all the tribes of Texas. The homes of this tribe for several centuries have been in the section surrounding Ysleta, their principal town on the Rio Grande. These Indians are credited with having built the towns whose ruins are to be found today in California and New Mexico. After the Spanish conquest the Pueblos readily adopted the Roman Catholic religion and accepted the peaceful occupation of shepherds after sheep were introduced by Coronado in 1540.

The Cenis tribe living on Buffalo Bayou and in the San Jacinto and Trinity valleys is perhaps the next most civilized that was found in Texas. They lived in large and populous villages. They devoted much of their time to agriculture. They were great traders and through their allies, the Comanches, they secured horses, spurs, silver articles, and clothing from the Spaniards.

The Nassonis, or Nassonites, is a name designating several Indian tribes, who lived to the east of the Cenis tribe on the Sabine. They were known for their kindness to strangers and their domestic habits. They raised corn and practiced a crude form of agriculture.

Another tribe of this section was the Caddos that came to Texas from Louisiana. They lived in large villages from the Sabine and Red rivers to the Trinity. Their farms were fairly well cultivated and

well stocked. They manifested considerable capacity for civilization.

The Wacos, who lived on the Brazos and upper Trinity, were also domestic Indians. They cultivated their farms and raised horses and built homes, but they were less friendly and reliable than the other tribes that have been mentioned.

In contrast with the peaceful and domestic habits of these tribes were the Comanches, Kiawas, Apaches, and Wichitas. The Comanches and Kiawas were notable for their treachery, avarice, and vindictiveness. They lived in populous villages in the mountains and headwaters of the river systems. They extended their operations from the Gulf Coast to the northern part of the State and as far east as the Trinity. The Apaches made their depredations from New Mexico and Arizona. The Wichitas, a fierce and large tribe, inhabitated the Wichita Mountains and the Red River country. These tribes not only were not interested even in a crude type of agriculture, but they were a continuous menace to agricultural development on the part of their more domestically inclined brothers, as well as to the European settlers who soon undertook to colonize and develop the country.

INFLUENCE OF MISSIONARY ENTERPRISE ON AGRICULTURE

The history of Texas agriculture would be incomplete without a brief review of the efforts of the Span-

ish missionaries to teach the Indians to cultivate the soil. The preceding discussion indicates the problems that confronted them in their efforts to transform the Indian from savage to civilized life.

The news of La Salle's expedition was brought to Mexico by the Spaniards who captured the St. Francois, the supply ship of the French expedition. This caused the Spanish settlers in Mexico to realize that their supremacy in Texas was being threatened by the French. Two vessels were dispatched (1686-1687) from Mexico to search the coast for the French colony. A short time later (1689) an overland party also was sent in search of La Salle's colony. The first expedition discovered the wreckage of the La Belle and L'Aimable, two of La Salle's ships, while the land force found the ruined and abandoned fort on the Lavaca River. De Leon, the head of the land expedition, learned from the Indians that some of the colonists were still living with the tribes to the east. This caused him to continue his journey until he came in contact with the Cenis tribe. He was received with cordial hospitality and the domestic habits of these Indians made a very favorable impression on him.

On his return de Leon reported to the Viceroy of Mexico his observations of the country. He praised the disposition and habits of the Indians and recommended that missionaries and military posts be established throughout the country. The Council of the Viceroy acted favorably on this recommendation and in 1690 de Leon, with 110 men, and a few friars,

returned and established at Fort St. Louis the Mission of San Francisco. This mission was located a short distance west of the Neches River near the present town of Crockett. As soon as the log church and barracks for the padres could be built, horses and cattle were sent in and a beginning was made in the cultivation of the soil. The Tejas [1] Indians were a semi-agricultural people. They were accustomed to the cultivation of corn, tobacco, melons, beans, and a kind of squash. It was easy, therefore, in the beginning to develop friendly relations with these Indians and to teach them the arts of agriculture as they were known to the Spanish colonists.

Eight more missions were projected by the Spanish and that of Santa Maria was actually located among the Cenis tribe, and buildings were erected. In 1691, Don Domingo de Teran, successor to de Leon, accompanied by nine Franciscan friars, came into Texas with the ambitious purpose of establishing a mission and beginning the cultivation of the soil and the development of ranching for the raising of horses and cattle. However, in a short time these missionary enterprises began to decline. The Indians started to rebel. Droughts caused the failure of crops

[1] The State is generally conceded by historians to have derived its name from this Indian tribe. Kennedy is authority for the statement that De Leon gave the name of *Tejas* to the Nassonite Indians, because of their friendly disposition, the word meaning friendly in the Indian language. The first official use of the word was in the diplomatic correspondence between De Alarconne and La Harpe. In early times the inhabitants were often referred to as Texians, Texcisians and Texicans.

and most of the cattle died. These misfortunes resulted in the abandonment of these missionary enterprises for the time being.

Thus the closing years of the seventeenth century (1694-1700) found Texas without European settlers. The efforts of the Europeans may be said to have done little more than to acquaint the Indians with sheep, cattle, and horses. Little progress was made in teaching them to till the soil.

The Spanish government renewed its efforts to take possession of Texas early in the eighteenth century. Fear of French conquest was again the immediate cause of the renewal of the efforts of Spain to possess the land. Louis XIV had granted to Anthony Crozat the monopoly of the trade in the Louisiana territory extending to the Rio Grande. Crozat sent St. Denis in 1714 on a trade trip and he penetrated the territory of Texas. This caused the Viceroy to assemble seven or eight families, about fifty soldiers and twelve friars and start them for Texas in charge of Captain Domingo Ramon (1716). The equipment consisted of a train of pack mules and oxen and approximately a thousand goats.

They were kindly received by the Tejas who allowed the friars to rebuild the St. Francis de las Neches (Nacogdoches) Mission. The Purissima Conception Mission was also rebuilt for the Cenis Indians. A total of seven missions was established between the Trinity and the Red rivers. About the same time the Mission of San Antonio de Valero was founded on the San Antonio River.

All of these missionary enterprises started off well, but the outbreak of war between France and Spain in 1719 brought dire results. French and Indian troops from Louisiana advanced into this section and destroyed these missions. The Spanish colonists were compelled to take refuge at San Antonio.

Not to be thwarted by these reverses, efforts at colonization were renewed by the Spanish in 1721. Under the guidance of the Marquis de Aguaya a band of 500 soldiers, thirty families, and a great herd of cattle and horses and a flock of sheep re-entered Texas. The missions beyond the Trinity were rebuilt.

The efforts of the Spanish to colonize Texas now became a matter of earnest purpose. An order was issued (1722) that 400 families should be sent from the Canary Islands at the expense of the Spanish Government. A little later an order was issued (1729) that every ship clearing from the port of Havana should have on board twelve families destined for these new possessions. The rewards offered the colonists were free land, full citizenship, and maintenance for the first year. These inducements resulted in some thirty families being brought to San Antonio and a similar colony of fifty families to San Augustine. However, neither colony was successful. These immigrants proved less industrious than the natives. They preferred to live by hunting and fishing, rather than by tilling the soil. The result was that neither settlement prospered.

The missionary efforts among the Tejas and Cenis

tribes began to show results. These Indians were taught to cultivate the soil under the direction of the friars. While the farms were cultivated in common, each man had his own garden. In addition to agriculture, the natives were taught such trades as carpentering, blacksmithing, bricklaying, and weaving. A crude system of irrigation was practiced by impounding the water of the streams in irrigation ditches and distributing it when necessary over the fields. By this method corn, beans, pumpkins, and melons were grown in abundance. Sugar and sirup made from cane raised at the missions were produced. Attention to the care and breeding of animals resulted in greatly increasing the number of horses, cattle, hogs, sheep, and goats. The success of agricultural enterprises in these missions is well described by Miss Katherine Coman in the following language:[1]

"The labor expected of the people was not thought onerous by the Spaniards. Husbandmen planted the fields, watered the crops, cleared away the weeds, and gathered in the grain. The carpenters and masons put up the adobe huts, the granaries, and the friars' dwellings. The women and children carded the cotton and spun it on malacates, the primitive Indian spindles, and the men who had learned the art wove this into cloth. The natives worked so slowly and carefully, however, that it was necessary to have a Spanish overseer constantly on

[1] *Economic Beginnings of the Far West*, Volume I (Explorers and Colonizers), p. 100.

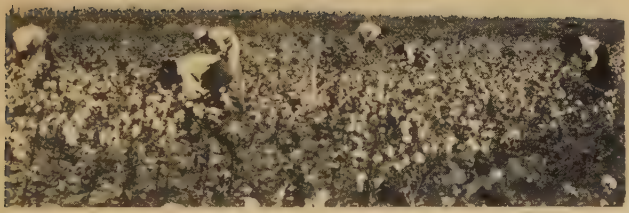

PLATE IV. Above, a typical cotton picking scene in Texas. Below, a view of a prolific variety of cotton developed at the State agricultural experiment station in Bell County.

hand, and even so, four native laborers were not equal to one European. Each mission raised corn and beans sufficient for its own needs, while the increase in cattle served for outside traffic. The friars might have developed a considerable commerce had not the settlers protested against their selling in the same market. However, cattle were sold as opportunity offered, and the secured bills received in exchange were forwarded to the superior at the City of Mexico, who laid out the proceeds in supplies for the mission,—cloth, hats, tobacco, needles, knives, pots, *metates,* hatchets, crowbars, saddles, and bridles. Chocolates for the special delectation of the friars, and drugs for the restoration of the sick, together with the ornaments and sacred images and other appurtenances of the church, were furnished at cost of the royal treasury."

. The picture of mission life as here described was not typical and it was not to be of long duration. Efforts to teach the Indians the peaceful pursuits of agriculture were only partially successful. Many tribes were never brought under missionary influence, but, on the other hand, were constantly engaged in tribal wars. Gradually toward the end of the seventeenth century the missions declined. Indian tribes, such as the Cenis, that had benefited most from missionary effort, were gradually driven from their ancient homes on the Trinity by the migrating tribes from the Mississippi Valley, who were themselves retreating before the advance of the aggressive Europeans.

AGRICULTURE DURING THE COLONIAL PERIOD

It is rather surprising that the population of Texas at the beginning of the nineteenth century was estimated at only about 7,000 inhabitants, of which some 2,000 lived in San Antonio. This population was composed of Spanish, Creoles, a few French and American settlers, and half-breed Indians of domestic habits. A large part of this population was engaged in hunting buffalo and wild horses. The buffalo supplied them with meat and with the horses they carried on a contraband trade with the inhabitants of Louisiana. Governor Cordero, in an effort to develop the agriculture of the country, restricted the hunting of buffalo to one season of the year and ordered each family to cultivate a definite quantity of land.

Here and there agriculture and live-stock production became important enterprises. A number of flocks of sheep and herds of horses and cattle were developing in the range country between the Concho and Rio Grande. The town of El Paso (then called Paso del Norte) was flourishing, due to the agricultural development about it. At the bridge over the Rio Grande, two miles above the town, a dam was built and from it water was supplied for irrigating the farms below. This made it possible to raise excellent wheat and other small grain. Wine was also produced from the numerous vineyards, and was sold in New Mexico, Chihuahua, and Coahuila. Immense flocks of sheep were also raised near El Paso

and annually driven to market, which was a considerable source of income and profit.

This, in brief, illustrates the conditions of agriculture in Texas preceding the treaty of 1819, by which the United States government acquired Florida from Spain. It is significant that in the same year Moses Austin applied to the Spanish government at San Antonio for permission to establish an agricultural colony in Texas. After some delay his request was granted, but before Austin actually entered on this enterprise he died. His son, Stephen F. Austin, succeeded to the task of his father. He immediately left his Missouri home for Texas and arrived in San Antonio just about the time Mexico secured her independence from Spain in 1821. Fortunately he succeeded in getting his grant confirmed by Iturbide. He selected the area between the Colorado and Brazos rivers and the old San Antonio Road and the Gulf.

Austin was obligated to bring the land under cultivation within two years. He immediately set about the task of inducing settlers to join his colony. He offered to every adult male 640 acres, for his wife 320 acres, for each child 160 acres, and for every slave eighty acres. A nominal charge of twelve and a half cents an acre was made for transportation of emigrants and the cost of surveying the land. Austin's settlers came from Tennessee, Mississippi, and Louisiana. On the whole, they were men of the best frontier type. They possessed energy and endurance and they were honest and determined.

[illegible] unsuccessful large enterprises, but this was not known at the time.

The rapidity with the colonies develop that by 1830 the population had grown to more than 20,000. Not only did the number of colonies increase, but additional families were being attracted constantly into the colonies already established. Austin's, Leftwich's and Edward's colonies adjoined Louisiana. Mexican and Mexican colony spread to the Trinity, while Mexicans pushed northward into their own land. The Texans, however, were in the more favorable in their colonization plans of 1830 than they had been a century before. In the first place, the foreign representation had been more favorable in the area selected for colonization. It happened that the contiguous section along the Gulf coastal from the Nueces River to the Sabine was the most desirable agricultural land of Texas. The Spanish empresarios were also benefited by the fact that the most favorable region was to Mexico along the Rio Grande and the Rio Grande was largely sterile and arid, which made the section peculiarly unattractive to agricultural settlers. In view of this situation it is not surprising that in 1831 there were reported to be seven thousand Americans and only 4,000 Mexicans in Texas.

When the Mexican government came to realize the disparity between the native and foreign population, an effort was made to offset the situation by less favorable colonization laws and greater restriction on foreign emigrants. More favorable inducements were made to encourage Mexican settlers to come to Texas.

Mexican convicts were sent to Texas to work roads with the promise that they could acquire land of their own and settle in the country when their terms expired. A Mexican law of 1834 provided that prospective settlers from Mexico would be transported to Texas at government expense and supported for the first year at the rate of four meals a day, and in addition each family would be provided with farm implements, a yoke of oxen and 442 acres of land. However, these efforts proved futile.

That the actual conditions of settlement and development of Texas might be clearly understood, the Mexican government sent Don Juan Almonte to make a tour of the State in 1834. He devoted several months to travel and to study and on his return submitted a very significant report of his observations. He reported that in soil, climate, and productive capacity, Texas had no equal among the federated states. Already the country was developing a remarkable trade in agricultural products. The trade of the three chief agricultural areas was estimated by him as follows: Brazos, $600,000 mostly in cotton, the imports about $325,000; Nacogdoches, $475,000, mostly in cotton, skins, grain, and cattle, imports about $265,000; Bexar only about 10,000 skins of exports, making a total of $1,680,000. In the central department of the Brazos, Almonte estimated that there were 10,000 persons and about an equal number in the region of Nacogdoches. Most of the American immigrants came from the neighboring sections on their own initiative. In contrast with this

situation, he reported that the Spanish population was not more than half of what it was in 1806. Almonte admonished his people that immediate steps should be taken to settle this fertile and promising country by Spanish speaking people. Assuming leadership in this enterprise, Almonte announced his intention of establishing an eleven-league colony in Texas, but before he could formulate his plans the Texas Revolution started and when he returned to Texas he led an army rather than a peaceful colony of prospective settlers.

It was inevitable that a contest should occur between the American colonists in Texas and the Mexican government. Tyranny and misrule became unbearable. Their grievances were formulated at San Felipe on April 1, 1833. They included religious intolerance, the exclusion of emigration from the United States, the perversion of land grants, denial of trial by jury, failure to provide aid for public education, imposition of custom duties, and needless interference by military forces. Separate statehood for Texas was also demanded. The government ignored their demands and Santa Anna increased his forces in Texas. The massacre of the Alamo transferred the movement from one of equality of opportunity to a war for self preservation and independence. At Washington on the Brazos a convention was held on March 2, 1836. This convention promptly formulated a declaration of independence from Mexico, wrote a constitution and elected temporary state officers. The Texans triumphed over Mexico on

April 21, 1836, at San Jacinto. Texas now entered on the period of the Republic (1836-1846) and her people were again at liberty to pursue the arts of peace instead of those of war.

THE PERIOD OF THE REPUBLIC OF TEXAS

The period of the Republic of Texas was marked by agricultural advancement and financial hardships. The population was almost totally agricultural. Land was the only taxable property and it had very little value. While the agricultural resources of Texas were increasing, foreign trade in farm products was very limited and the people were greatly opposed to the levy of custom duties. The new government had incurred heavy obligations necessitated by war, and the limited sources of revenue created almost insurmountable difficulties. Bond issues were resorted to, land script was sold and promissory notes were given in payment of debts. Nevertheless, in a short time the indebtedness so far exceeded the resources that the bond issues and notes depreciated to twenty cents on the $100. Increasing difficulties confronted the administrative officers. The enforcement of law was impossible. There were no funds to maintain the army for the protection of the people and the defense of the frontier.

The only way out of this difficulty for Texas was in annexation to the United States. The slavery question made this a difficult matter, but, after several overtures on the part of the government of the

Republic, finally on March 1, 1845, a joint resolution was adopted by Congress proposing annexation. President Jones of the Texas Republic called a convention for the consideration of this question. There was no doubt as to the desire of the people of Texas. The convention accepted the proposal of Congress and on October 13, 1845, the ordinance and a new state constitution were ratified by the people. The final formalities were consummated by the passage of the joint resolution by the United States Congress on December 29, 1845, and the assumption of office by the State officers on February 19, 1846.

During the transition period agriculture in Texas was undergoing considerable change. "The settler from east of the Mississippi", says Miss Coman, "accustomed to the exhausting labor of clearing the forests before plowing could begin, who had often seen the better part of a man's life spent in reclaiming a few patches of cornfields which still remained incumbered by stumps and weeds and infected with malaria, rejoiced in the sunny, open prairies where the soil seemed prepared by nature for the farmer's use." [1]

As most of the settlers in Texas came from other southern states, they brought with them many of the agricultural practices of the older settled sections of the country. The fields to be cultivated were fenced in and the live-stock was permitted to run at large on the open range. Hogs were usually fattened

[1] *Economic Beginnings of the Far West*, Volume II (American Settlers), p. 103.

on the native nuts and the mast of acorns from the live oak trees. Once each year the cattle were rounded up, counted and identified by the respective owners and the yearling calves were branded.

Agricultural practices of this period are interestingly described by an English observer as follows: "A heavy plough and a strong team are required the first year, to break up the tough sward and turn over the soil. The Indian corn is dropped in the furrows and covered with a hoe, which with an occasional light ploughing to clear away the weeds, is the only labor bestowed upon it until it is fit to gather . . . . . By turning the grass down, exposing the roots to the sun, and leaving the soil undisturbed, the sward becomes mellowed in a single season, and while undergoing the process of decomposition, affords nourishment to the growing corn. In the ensuing spring, the roots of the wild grass are completely rotted, and the plough passes through a rich light mold fit for all the purposes of husbandry . . . . . The superior facility of working open land, the saving in the wear of farm implements, the economy of time, and, of course, the greater degree of certainty in the farmer's calculations, with the comparative exemption from local disease, give a pre-eminence to the prairie over the timbered land not to be materially reduced by any inconvenience that may be occasioned by an inadequate supply of wood. It would be sounder economy for a farmer to settle in the midst of a prairie and draw his fuel and fence wood five miles, than to undertake the clearing of

a farm in the forest. . . . . Supposing the soil of both to be of equal quality, a laborer can cultivate two-thirds more of prairie than of timbered land; the returns are larger, and the capital to be invested less".[1]

While the agricultural advantages of Texas were attracting an increasing number of farmers, it was still scantily settled and undeveloped. At the time of annexation the population of the State probably did not exceed 135,000. By 1850 the number had increased to 212,592, and to 604,215 in 1860. The population was almost wholly rural. The total in the twenty-three towns listed in the United States census of 1850 was only 20,209. Only five of these towns had over a thousand inhabitants. While most of these towns were merely villages, the population residing in them in 1850 was only 9.5 per cent of the total. The density of the population increased from .08 of a person in 1850 to 2.3 persons to a square mile in 1860.

The number of acres of improved lands in farms in 1850 was 643,976, while the unimproved land was 10,852,363. In 1860 the respective number of acres had increased to 2,650,781 and 22,693,247. Although agriculture was almost the sole occupation of the people, only 6.8 per cent of the total land area was in farms in 1850 and only 15.1 per cent in 1860. The vast, unoccupied area of the State was held as a part of the public domain, or owned in large part by non-resident speculators. The value of the farm

[1] Kennedy's *Texas*, pp. 117-118.

lands of the State increased from $16,550,008 in 1850 to $88,101,320 in 1860. The value of live-stock on Texas farms and ranches in 1850 was $10,412,927, and $42,825,447 in 1860. Cotton and corn were the most important crops. There were 58,072 bales of cotton, averaging 400 pounds each, produced in 1849. The number of bales was increased to 431,463 in 1859. The average price a pound for lint cotton for the period of 1846-1860 was eleven cents.

The period of the Civil War and the first few years of reconstruction were marked by retardation of agricultural development. The growth of population between 1860 and 1870 was the smallest of any decade in the State's history. The population only increased from 604,215 in 1860 to 818,579 in 1870. This was an increase of only 35.5 per cent as compared with an increase of 184.2 per cent during the preceding decade.

The productive and economic aspects of agriculture were not only vitally affected by this fact, but the change in the status of the negroes from slavery to freedom had a marked influence on the situation. The number of slaves in Texas in 1860 was 182,566, or 30.2 per cent of the total population. This vast number of poor and ignorant negroes had a decided influence on agricultural practices and land tenure. The number of negroes increased to 253,475 by 1870. The population of the State continued to be almost wholly employed in agriculture during this decade. The census of 1870 placed the number of the population over ten years of age engaged in

agriculture at 166,753. This was 70 per cent of the total of the State.

The value of the farm lands of the State decreased in the decade from 1860 to 1870 from $88,101,320 to $60,149,950, or 54 per cent. A decrease in the acreage of farm lands from 25,343,028 in 1860 to 18,396,523 in 1870, or 27.4 per cent, was reported. Farm acreage in proportion to the total decreased from 15.1 per cent in 1860 to 11 per cent in 1870. The only increase was in the percentage of improved farm land, which showed a growth from 10.4 to 16.1 per cent. These changes were reflected in the production of the period. For example, the number of bales of cotton decreased from 431,463 in 1859 to 350,628 in 1869, but the losses in production were more than offset by the increases in price. The price ranged from 43.2 cents a pound in 1865 to 17 cents a pound in 1870.

Agricultural conditions gradually improved during the decade beginning with 1870. The number of farms increased 185 per cent and the acreage in farms 97.3 per cent. The percentage increase in the improved farms was 326.6 per cent, but a large part of the land area was still undeveloped and unoccupied during this decade. The farm area was only 21.6 per cent of the total land area of the State.

The period from 1860 to the present time has been one of rather uniform progress with the exception of short intervals of retardation, due to drought or financial depression. By 1880 Texas had about recovered from the effects of the Civil War and the

handicaps of reconstruction. However, some of the effects of these continued to influence the economic and social status of agriculture for many years. The system of cropping or share-renting to farm tenants and the credit practices in connection with agriculture are the most notable of these survivals.

The increase in population and the comparison of the total with the rural population for the several decades since 1880 are indicated by the decennial census figures as follows:

Year	*Rural Population*	*Total Population*
1880	1,455,967	1,591,749
1890	1,886,016	2,235,527
1900	2,527,951	3,048,710
1910	2,958,438	3,896,542
1920	3,150,539	4,663,228

While the urban element is increasing, the rural population continues to the present day largely predominant. In 1890 the percentage of the rural population was 84.4 per cent; in 1900 it was 82.9 per cent; in 1910 75.9 per cent; while in 1920 it was 67.6 per cent.

Since 1880 an expansion of agriculture has resulted in a large part of the area of the State being reclaimed from a state of uselessness to one of production. The great grazing areas of the West have been gradually yielding in many sections to farming, or to live-stock raising. In 1880 21.6 per cent of the land area was in farms; in 1890, 30.6 per cent; in 1900 74.9 per cent; and in 1910 67 per cent. The

decline between 1900 and 1910 was due to the fact that land which was used for grazing in 1900 and was classified under "farm land" had gradually been cut up into smaller tracts and sold to actual farmers. During this period the southwestern part of the State and several sections in the middle west and the Panhandle of northwest Texas had been brought into cultivation. While the percentage of lands and farms has greatly increased, that of improved farms has declined. In 1880 34.9 per cent of the farm land was improved, while the percentage in 1910 was only 24.3 per cent. There was, of course, an enormous increase in the absolute acreage of improved farm land. The acreage of such was 12,650,314 in 1880, 27,360,660 in 1910, and 31,227,503 in 1920.

The census of 1920 estimated the total farm land of Texas at 114,020,621 acres.

The agricultural advancement of the State is also indicated by the increase in the value of farm property during the period of 1880 to 1920. The value of land and buildings was $170,468,886 in 1880, $399,971,289 in 1890, $691,773,613 in 1900, $1,843,203,395 in 1910 and $3,700,173,319 in 1920.

The significance of the agricultural wealth of Texas in comparison with that of the nation is indicated by the fact that the total value of farm land and buildings in 1920 was $67,795,965,000, while the total value of Texas farm property in 1920 was estimated at $4,447,420,321. The value of the livestock was $60,307,987 in 1880, $339,433,843 in 1910, and $592,926,006 in 1920.

The present significance of agriculture in Texas is somewhat indicated by the number, average size, and value of the farms. According to census figures of 1920, there are 6,459,998 farms in the United States. The total number of farms in Texas is 436,033. While the number of farms in the United States increased only 98,496, or 1.4 per cent, from 1910 to 1920, the total number in Texas increased 18,263, or 4.2 per cent during the decade. The average acreage was reported to be 265.5, while the average acreage of improved farm lands was 71.6. The average value of farm property increased from $5,311 in 1910 to $10,200 in 1920. The average value of land and buildings increased from $4,412 in 1910 to $8,426 in 1920. The average value of land alone increased from $3,909 in 1910 to $7,443 in 1920. The average value of an acre of land and buildings was $16.39 in 1910 and $32.45 in 1920. In other words, the increase in the value of farm land has been approximately 100 per cent in the last decade.

RANCHING IN TEXAS

Stock-raising in Texas first developed on the open range. Ranching may be said to have been a later development of the cattle business. The transition from the range to ranching has been a distinct phase in the economic development of the Southwest. The distinction between range and ranch cattle production has been defined as follows: "The range applies to the raising and fattening of cattle upon public lands,

or unfenced lands generally, where the herds of different proprietors are free to range and intermingle; whereas the ranch cattle business is carried on within the enclosures belonging to cattlemen on which their own cattle graze".[1]

The open range in the United States was made possible by the vast and undeveloped lands of the West and Southwest. Cattle production on the open range was characteristic of the pioneer conditions and has slowly receded in the wake of settled farm life.

The cattle range business did not develop in Texas to any great extent until the latter part of the eighteenth and the early nineteenth century. It was about this time that one began to hear of a few land owners who lived in feudal isolation on the ranchos, or cattle ranges. The rancheros were hardy, reckless, and improvident men whose wealth consisted of numberless cattle and horses that grazed the boundless ranges. Cattle-raising on ranges was conducted on a vast scale. In many sections the stockmen considered that five to thirty acres were required for sustaining one animal. To sustain large herds on this basis required vast areas of grazing lands. As indicated in a preceding connection, cattle were not native to the United States. They were brought into the Southwest by the early explorers. Most of these cattle were of Moorish or Castilian origin and came from Spain. Coronado brought cattle into Texas from Mexico as early as 1540. The first Spanish settle-

[1] See Lippincott's *Economic Development of the United States* (1921), Chap. 28, p. 401.

ment in the Southwest was in New Mexico. Cattle were raised and sheep introduced into this colony before 1680. The cattle ran at large on the ranges and stock-raising became quite an industry among the Indians of that section. This colony was probably one of the earliest sources of Texas cattle.

Louis de St. Denis found that the Tejas had cattle in considerable numbers when he visited them in 1714. The cattle industry developed rather rapidly in east Texas during the last half of the eighteenth century. Antonio Gil Ybarbo is reported to have had a large herd of cattle. When the settlers were forced to leave east Texas and move farther west they complained bitterly about losing their herds. "We are told that cattle ran wild on unsettled land, being known by their earmarks".[1]

Stock-raising, however, was not a profitable industry during the early period. The climate and range conditions made it possible to increase the number of cattle rapidly, but transportation to market was difficult and there were numerous restrictions on trade. De Mezieres quotes the price of the fat cow in 1779 at four pesos, a three-year-old sheep at six pesos and mares in droves at a peso or less a head.

Many of the early colonists brought live-stock to Texas with them. Most of them were American native cattle, but some French cattle were also brought in from Louisiana. The American, or native cattle,

[1] See Clara M. Love's *History of the Industry in the Southwest*, Southwestern Historical Quarterly, Volume 19, p. 372.

were hybrids from various original stocks. Cattle in Virginia had been imported from the West Indies in 1624. The cattle in New York came from Holland and those in New England from Old England in Colonial times. There were some Swedish cattle along the Delaware River. By 1830 there were said to have been approximately 100,000 cattle of all kinds in Texas. About four-fifths of this number were of Spanish breed.

During the period of the Republic of Texas, "cowboys" began the practice of collecting herds of wild cattle and driving them to interior points and to New Orleans where they were sold. A drove was taken into Missouri as early as 1842. Unbranded cattle found upon the ranges were declared to be the property of the Republic. However, range cattle were of very inferior grade and of little value.

A story illustrates how one phase of the cattle business developed in Texas: "In 1864 a Government freighter, on the way to Camp Douglas in Utah Territory, was overtaken on the Laramie plains by an unusually severe snow storm. The teamster turned his cattle adrift believing, as a matter of course, that they would die of cold and starvation. But it happened that dried grasses, obtained from patches where winds had blown the snow off the highlands, afforded abundant forage, and, when spring came, the animals were in better condition than when turned out to die some months before".[1]

This experience resulted in a market outlet for

[1] Lippincott's opus citus, p. 402.

Texas cattle. Before the end of the Civil War well-established cattle trails were marked out and numerous herds were driven to California, Nevada, Utah, and other western states. By this means the ranges in these sections were stocked with Texas cattle and a regular trade was established.

However, this traffic did not begin to consume the supply of cattle. Some Texas beef was marketed during the Civil War at Mobile and New Orleans. This was shipped by the Morgan line of ships from Texas ports, but exorbitant freight rates prevented the trade from developing to larger proportions. A few droves of cattle were marketed to the Confederate armies. They were required to swim the Mississippi River and then were delivered at Vicksburg, but the Union gunboats soon cut off this source of trade.

The transition from range cattle production to ranching was gradual. The process of making the transfer comprises one of the most interesting chapters in the history of the cattle industry. It was inevitable that a conflict between the cattleman and settler must come sooner or later. It arose in connection with the State's policy of dealing with the public domain. In the early years the State laws favored the cattleman rather than the farmer. As late as 1870 every gardener or farmer was required to maintain a fence around his cultivated land. In the beginning the "squatters" were few in number and of little consequence, but as time went on the number increased rapidly. Many came from the East, advancing along the water-courses and into the fer-

tile valleys. Cowboys, weary with the hardships of the range, frequently established a claim and settled down. The cattlemen gave these settlers the title of "nester" in derision. The "nester" was poor and hardly prepared to compete with the cattle baron, but he had a keen sense of his rights and was usually a man of courage. The cattleman, as a rule, was a man of energy and determination. In an effort to stop "nesting," the cattlemen began to inclose their vast ranges with wire fences. The fences usually involved the sources of the water supply and often cut off highway communication over vast areas. This policy resulted in warfare. When the nester found a fence in his way he cut the wire. To protect their fences the cattlemen provided fence riders. The nesters began to shoot the fence riders from ambush. The fence riders retaliated, but the fences continued to be cut. Finally, in 1884, the situation became so serious that Governor Ireland called a special session of the Legislature to consider the matter. A law was passed making it a penitentiary offense to cut a fence. The ranchmen were required to put in gates every three miles and to keep the public roads open. This law had the effect of putting a stop to fence cutting and established ranching on its present basis.

Gradually the State developed a system of leasing public lands. In 1893 the Legislature provided for the classification of the public domain. This law provided that some of the land could be sold, some of it should be subject to lease only, while a part of it could either be sold or leased. Pasture lands on

the open prairies were subject to lease at four cents an acre per annum. Land deemed desirable for cultivation was subject to actual settlers to the extent of 640 acres. The settler was required to fence the land and live on it. If the leased land contained one water section, that could not be sold during the life of the lease. In 1884 the rent for leased lands was increased to eight cents an acre and a penalty involving a fine or imprisonment was fixed for any person who knowingly fenced or herded his cattle on state land without a duly executed lease.

The laws were revised further in 1887, 1889, and 1891. The object of these laws was to protect the range from over-stocking and to give larger opportunity for land settlement. A limit on the time that the lease could run on grazing land was fixed at ten years. The number of cattle on an unfenced range was limited to a certain number of head. Any improvement placed on leased lands was recognized as the property of the lessee and could be removed within a period of sixty days after the expiration of the lease. More favorable terms of leasing for actual settlers brought on another conflict. The so-called "Rustlers' War" was one of the developments of this situation. The general impression is that the word "rustler" was a term to represent a cattle thief. This is not entirely correct. Originally "rustler" was the term used to designate a cowboy who was paid a definite sum for every "Maverick" that he found and branded with his employer's brand. The term "Maverick" is derived from a cattleman in Texas who

so completely neglected his herd that his neighbors formed the practice of putting their own brand upon unbranded or "Maverick" cattle. As the country began to settle up and fences were built to safeguard the ranchmen's cattle, opposition began to develop to the practice of branding calves by "rustlers." Soon the big ranch owners combined against the small owners. It was agreed that no more "Maverick" commissions should be paid to cowboys. Soon a conflict developed between the larger cattle owners and the "rustlers," and the latter began to be looked on as thieves and outlaws. Many of the rustlers deserved this designation. They did steal cattle. They even went so far as to tamper with brands so that they might change them and appropriate cattle whose owners were definitely known. This warfare went on for many years during the slow transition from the open range to the fenced pastures.

A conflict of larger significance was that between the longhorns and shorthorns. The cattle-raisers of some of the old states were very much opposed to the admission of the Texas cattle to their sections. The longhorn Texas cattle were not looked on with favor where breeders had developed a better type of beef animal. This opposition had a reasonable basis because of the contagion of Spanish or Texas fever which was very common in the southern part of the State. Animals driven directly from the pastures of Texas into northern states spread this disease among the northern cattle. The Illinois Legislature passed an act excluding all Texas cattle from entering that

state, unless they had been wintered on the plains. It was generally believed by the Texas cattlemen that the Illinois Legislature was influenced in the passage of this law more by the fear of Texas competition than by the danger of the spread of Texas fever. The cause of Texas fever was not known for many years. Because of this situation a number of western states passed live-stock sanitary laws. For example, Dakota, in 1886, passed a law refusing to admit cattle from Texas unless they had been driven all the way. The fact that Mexico was the original source of Texas fever and that many cattle were imported from that region to the United States caused Congress to pass an act in 1890 providing for restrictions on all cattle imported into this country. This situation caused many cattlemen to experience great hardships and difficulties in their efforts to get their cattle to the northern markets. Cattlemen in the states through which they were compelled to pass became hostile and in some cases the Texas stockmen were kidnapped and their cattle confiscated.

The conflict between the sheep and cattle interests never became as serious in Texas as in the other western states, but the problem out of which this conflict arose had profoundly affected the live-stock interest in Texas. Sheep were believed to be very detrimental to the cattle range. Ranchmen were of the opinion that cattle would not go where sheep had run and would not drink from the same tanks. The cattlemen, therefore, were very much opposed to the use of the range by sheep-raisers. From 1893 to 1903 this

warfare became very acute and extended very generally over the grazing states. In some cases the sheep owners were imprisoned and their sheep destroyed.

Experience taught the ranchmen the need of conserving the range. A traveler reported that one square mile of pasture would support 300 head of cattle, but by 1898 not more than fifty head could be sustained on this amount of land. The great cattle boom of the late seventies and early eighties encouraged over-stocking. Range improvement up to that time had received no scientific consideration.

The Panhandle of Texas did not develop its live-stock interests until rather late. This section was partially stocked by 1876 and the following year Colonel Charles Goodnight brought in a herd of 2,200 head of cattle from Colorado. By 1880 there were more than 225,000 head of cattle on the upper plains. In more recent years the plains country has developed into one of the most important live-stock sections of the United States.

The cattle industry was the source of a number of large fortunes in Texas during the latter part of the nineteenth century. Some of the ranches were of vast extent. In the early days of ranching the Santa Gertrudis, owned by Colonel Richard King, consisted of 84,132 acres. At one time it was stocked with 65,000 head of cattle, 10,000 horses, and 8,000 goats. The O'Conner ranch on the San Antonio River supported 40,000 head of cattle. There were 12,000 calves branded on this ranch annually. There are

many familiar names connected with the cattle industry in Texas. Most of these men made fortunes in this business. Among the names of those most familiar are George W. Littlefield, Colonel C. C. Slaughter, John Scharbraur, Sugg Robinson, Winfield Scott, and Ike Pryor.

The range country in Texas is being increasingly encroached on by farming enterprises. Great ranches are being broken up and sold to farmers. Undoubtedly much more of this ranching area is destined to be utilized for crop production, but it is well known that there are areas in several sections of the western part of the State that will probably never be adapted to agriculture. There is great need for a scientific survey of the adaptable areas for irrigation, dry-land farming, and ranching. It is certain that, due to surface conditions, limited rainfall, and the nature of vegetation, ranching will continue to be an important industry in Texas for a long time.

CHAPTER V

LAND UTILIZATION IN TEXAS

The land area of Texas is estimated at 167,934,720 acres. Of this total 114,020,621 acres, or 67.9 per cent, are classified as farm lands. There are 31,227,503 acres, or 27.4 per cent, in improved farms, 14,532,913 acres in farm woodland and the balance, comprising 68,260,205 acres, is in unimproved land in farms. While there was a decrease in the total acreage in farms from 1900 to 1910 of 10.6 per cent, there was an increase of 1.4 per cent in the last decade, from 1910 to 1920.

The acreage in improved land has shown a continuous increase in each census report, except that for 1900 when a decrease of 5.6 per cent was reported. The increase in improved land was reported at 39.8 per cent in 1910, and at 14.1 per cent in 1920. A slightly different classification is given in Youngblood and Cox's "An Economic Study of a Typical Ranching Area," as follows:

Classification	*Number of Acres in Classification*	*Percent of Total Landed Area in Classification*
Total	167,934,720	100.0
Grazing area	123,348,517	73.4
Improved lands in farms	31,227,503	18.6
Forest and woodland	10,000,000	6.0
Roads, cities, towns, riverbeds and so forth	3,358,700	2.0

The census reports a total of 436,033 farms in the State. The number of farms increased by 18,263, or 4.4 per cent, in the decade from 1910 to 1920. The average acreage to a farm was reported in 1910 at 261.5, but the improved acreage was only 71.6 in 1920. The average acreage of farms in the State declined rather rapidly from 1850 to 1880, but since that time the tendency has not been uniform. There is even greater variation in the average acreage of improved farms. The actual figures as compiled for census data are as follows:

Total acreage in all forms of land, total in improved acreage and average acreage to a farm of all farm land and improved land as reported in each census since 1850 are presented in the following table:

Census Year	Land in Farms		Average Acres to a Farm	
	All Lands Acres	Improved Land Acres	All Lands	Improved Farms
1920 ...	114,020,621	31,227,503	261.5	71.6
1910 ...	112,435,067	27,360,666	269.1	65.5
1900 ...	125,807,017	19,576,076	357.2	55.6
1890 ...	51,406,937	20,746,215	225.3	90.9
1880 ...	36,292,219	12,650,314	208.4	72.6
1870 ...	18,396,523	2,964,836	301.0	48.5
1860 ...	25,344,028	2,650,781	590.9	61.8
1850 ...	11,496,339	643,976	942.5	52.8

In the interpretation of these figures it is well to keep in mind the definitions and precaution contained in the census report, as follows:[1]

[1] Bulletin of the Fourteenth Census of Texas Agriculture, p. 3.

"Improved land includes all land regularly tilled or mowed, land in pasture which has been cleared or tilled, land lying fallow, land in gardens, orchards, vineyards and nurseries and land occupied by farm buildings.

"Woodland includes all land covered with natural or planted forest trees which produce, or later may produce, firewood or other forest products.

"All other unimproved land includes brush land, rough or stony land, swamp land, and any other land which is not improved or in forest.

"The Census classification of farm land as 'improved land,' 'woodland,' and 'other unimproved land' is one not always easy for the farmers or enumerators to make, and the statistics, therefore, must be considered at best only a close approximation."

It should be observed also that the average acreage to a farm in the tabulation on page 138 does not supply very accurate information with reference to the actual size of Texas farms. The sum or aggregate of the number of farms varies between such wide limits as to make the average rather unsatisfactory. A better approximation of the utilization of farm lands may be ascertained from a group classification on the basis of acreage of farms of the State. A compilation from the last census appears in the table on page 140.

Crop-farming, combination crop and stock-farming, and ranching are the three most distinct types of agricultural endeavor. The available agricultural statistics unfortunately do not separate farms on the basis of this classification. It is, therefore, impos-

NUMBER OF FARMS AND PERCENTAGE DISTRIBUTION BY ACREAGE IN 1910 AND 1920

Size of Group	No. of all Farms		Percentage of all Farms	
	1920	1910	1920	1910
Total No. Farms....	436,033	417,770	100	100
Under 10 acres.....	7,892	9,480	1.8	2.3
10 to 19 acres.....	17,986	19,891	4.1	4.8
20 to 49 "	110,387	98,583	25.3	23.6
50 to 99 "	119,427	112,237	27.4	26.9
100 to 499 acres.....	156,365	153,623	35.9	36.8
500 to 999 "	12,709	12,833	2.9	3.1
1000 acres or over.....	11,267	11,123	2.6	2.7

sible to determine accurately the number of crop farms, combination crop and stock farms, and ranches. The figures in the tabulation above, however, throw some light on this matter. Since truck-farms are generally confined to small acreage, the figures indicate that this type of farming is rather restricted in the State. This is known to be true. Since ranching is confined, in general, to large acreage, the figures indicate that the number is included in the group of 1,000 acres and over, which is estimated at 11,267 farms. It is well known that there are many crop farms and combination crop and stock farms that exceed 1,000 acres. Therefore, it is obvious that the number of ranches in the State is considerably below this figure.

METHODS OF INCREASING FARM PRODUCTION

The preceding discussion indicates, in general, the nature of land utilization in Texas, but a topic of

greater importance relates to the methods that are being applied for the increased utilization of the land area of the State. Lands extending over considerable areas are never equally well-adapted to crop production. Many soil types are deficient in plant-food. Inadequate rainfall, or rainfall that normally does not occur during the growing season, often makes lands of good quality valueless. Rich soils of river valleys are frequently subject to overflows which greatly affect their value for farm purposes. Other lands of good producing quality are too marshy to make cultivation possible. All of these conditions exist in one or more sections of Texas. Methods that are being applied to overcome these difficulties as a means of increasing acreage production and enlarging the areas of agricultural enterprise are of inestimable value to the State.

The increasing use of fertilizers on deficient soil types, irrigation in the arid or semi-arid regions, or in sections where irrigation is required because of the peculiar nature of the crop produced, and reclamation and drainage of overflowed and swampy lands are the most important methods being applied as a means of enlarging the productive area of the State and increasing actual production to the acre.

The principal deficiency of Texas soils is in nitrogen and organic matter. There is great need for a proper legume rotation for supplying this deficiency. Fertilizers also are required for many soils in order to secure the best crop yields. Texas agriculture is still in the stage of soil mining, and scientific agri-

culture based on suitable crop rotation, aided by the use of fertilizers, is largely a matter of future farm practice. There is an increasing tendency on the part of farmers to give consideration to this important problem. Farmers are gradually adopting the policy of diversifying their crops and increasing the use of fertilizers. The largest amount of fertilizers is consumed in east Texas. The counties using the largest quantities of fertilizers are Smith, Cherokee, Gregg, Bowie, and Rusk in northeast Texas, Jasper and Harris in southeast Texas and Webb in southwest Texas. Campaigns conducted by the Extension Service of the Agricultural and Mechanical College in east Texas have increased the interest in soil improvement. According to the Annual Report of the Extension Service of the Agricultural and Mechanical College, there were 474 fertilizer demonstrations conducted in 1922. There were 86,118 tons of fertilizer used on such demonstrations, and forty-three communities were influenced to buy fertilizers cooperatively. The soil studies that have been made in recent years by the Division of Chemistry of the Agricultural Experiment Station and the soil surveys that have been conducted jointly by the Station in cooperation with the Bureau of Soils of the United States Department of Agriculture have also directed public attention to soil problems and possibilities. The effect of these activities has exerted an appreciable influence throughout the State.

Irrigation is another important means of increasing the utilization of the land. It is not a new

enterprise in Texas. In the vicinity of El Paso early explorers found irrigation ditches which gave evidence of having been used by a race of people inhabiting the region prior to the coming of the Indians. These ditches revealed engineering knowledge and skill in their construction and from their great age it would appear that they were undoubtedly well built. While irrigation in Texas is not new, its development on an extensive scale is comparatively recent. In 1860, according to the Bureau of the Census, there was one irrigation project covering 400 acres in Texas. In 1870 the area under irrigation had increased to 23,000 acres, and in 1890, to 45,000 acres. The acreage had increased to 134,832 in 1900, to 451,130 in 1909, and the last census reports 586,120 acres under irrigation in 1919, with 1,687,447 available for irrigation by existing systems. The number of farms subject to irrigation was reported at 5,974 in 1920. One and four-tenths per cent of all farms of the State are under irrigation, and three-tenths of one per cent of the land area of Texas is subject to irrigation.

Irrigation is practiced to a greater or less extent in forty-four counties in widely separated sections of the State. The sources of water supply, the methods of irrigation, and the extent of irrigation projects vary with local conditions. More than 200,000 acres were irrigated in 1919 in the southeast coast counties of Texas in the rice belt. The counties with acreage irrigated for the cultivation of rice in 1919 were as follows: Brazoria 350, Chambers 29,200,

Colorado 15,321, Harris 8,000, Jefferson 74,002, Liberty 13,500, Matagorda 33,510, Orange 13,882, and Wharton 19,512. In this section there are many sluggish streams with large discharges. Water for irrigation purposes is pumped from these streams to the level prairie lands between the river channels. Also some water is supplied from wells by individual farmers on their own land.

Irrigation is carried on extensively in the lower Rio Grande Valley in Hidalgo and Cameron counties. At the present time 38 per cent of the land under irrigation in Texas is in these two counties. The Rio Grande is the source of water for the citrus-fruits and winter vegetables produced in this section. The Bureau of the Census reports an increase in Cameron County of 29,439 acres under irrigation in 1909 to 60,008 acres in 1919; and an increase in Hidalgo County of 21,048 acres in 1909 to 160,532 in 1919. The total acreage in irrigation in the two counties has increased 170,053 in the ten-year period. There is possibility of greatly increased acreage in irrigation in this section. According to estimates it is possible to irrigate with present facilities 178,414 acres in Cameron County, and 388,532 in Hidalgo County. In other words, it is possible to increase the total acreage in these two counties from 220,540 to 566,946 acres with irrigation systems. At times the volume of water in the Rio Grande becomes comparatively small and, if the irrigation area there is to be greatly extended, it will be necessary to construct vast storage reservoirs in the canyon sections

of the river and bring the water through canals by gravity. This project is being seriously discussed at the present time and coöperation between the federal and state governments will probably result in an effort to carry out this plan. It will also be necessary at an early date to secure some kind of a treaty agreement with Mexico with reference to the water rights of the Rio Grande, as it is certain that the volume of water available under present conditions will not be sufficient to meet the needs if irrigation becomes generally practiced on the Mexican side of the river.

Farther up the Rio Grande, in Webb County, there are 7,480 acres under irrigation surrounding Laredo. The source of the water supply is also the Rio Grande, but the method of pumping is somewhat different from that of the lower Rio Grande section. Irrigation has made Webb County an important source of horticultural products, including onions, potatoes, and other vegetables. Alfalfa and other field crops are also grown sucessfully by means of irrigation.

In Valverde County in the vicinity of Del Rio 2,475 acres are irrigated from springs and from the Rio Grande. In the vicinity of El Paso 20,259 acres are supplied with water from the storage reservoir known as the Elephant Butte on the Rio Grande in New Mexico. Water is supplied from this reservoir to irrigation districts in New Mexico, Mexico, and Texas. This is one of the most important irrigation projects in this section of the country. Farm-

ing has become an important enterprise in El Paso County and the entire area subject to irrigation is rapidly developing.

Another rather important irrigation district is in Zavalla, Frio, Dimmit, and La Salle counties. The source of water is principally artesian wells. However, some water is obtained from the Nueces River. The acreage under irrigation in this county approximates 10,225 acres.

Still another irrigation district of considerable importance is that in the Trans Pecos region where the rainfall averages but thirteen inches per annum. There are 22,312 acres in Pecos County which receive their supply of water from the Comanche Springs and the Pecos River. These springs produce a remarkable volume of water, the flow being estimated at 55,000,000 gallons daily. In Reeves County in this same district there are 13,286 acres under cultivation, the water being secured from the Pecos River, artesian wells, and springs. Plans are in contemplation for greatly increasing this irrigation area by placing a dam across the Pecos River at Red Bluff, just across the Texas line in New Mexico. This increased source of water supply will more than treble available land for irrigation purposes in this section.

One of the largest and most recent irrigation projects in Texas is that on the Wichita River, in Baylor County. The dam has been completed and water will soon be available for irrigating a large land area in that section.

PLATE V. Above, harvesting rice in the Gulf Coast country. Below, rice sacked and ready for shipment.

One of the most interesting irrigated regions of Texas is in Hale County in the vicinity of Plainview. The rainfall averages about twenty-three inches a year, but most of this falls during June, July, and August, which is the growing season for crops in that section. The land is also very fertile. For these reasons, the county had become an important agricultural country before the adoption of irrigation methods. Even at the present time many of the wheat-growers do not avail themselves of irrigation methods in the production of crops. The gradual slope of the land and the fact that an abundant supply of water can be obtained from shallow wells made irrigation appear very attractive. Irrigation from a well was first tried out in this section in 1910. Since that time many shallow wells have been utilized for irrigation purposes. The Texas Land and Development Company has developed 60,000 acres, one-fourth of which is now under irrigation. There are many other smaller farms using irrigation methods in crop production in this section. Five tons of alfalfa with three or four cuttings a season are produced. Sugar-beets have yielded as high as fourteen tons an acre. Kafir and milo under irrigation have produced fifty to sixty bushels to an acre, and various saccharine crops return yields of three to five tons of feed to the acre. Vegetables also produce in abundant quantities in this section. At the present time there are 128 pumping power plants in Hale County, and many thousands of windmills are being utilized on farms in pumping water for irri-

gation purposes. Irrigation from shallow wells with an inexhaustible supply of water is a very attractive method. The area in the Plainview country will probably be extended considerably from year to year.

The profitableness of agriculture under irrigation conditions is indicated by the increased yields of staple crops on irrigated lands. Census figures show the following results for Texas: average corn production to the acre on non-irrigated lands was 22.7 bushels and 32.9 on irrigated in 1910; oats, 34.4 bushels on non-irrigated and 15.4 bushels on irrigated lands; winter wheat 15.1 bushels on non-irrigated and 14.7 bushels on irrigated land; kafir and milo, 24.6 bushels on non-irrigated and 31.8 bushels on irrigated; alfalfa 2.1 tons on non-irrigated and 2.85 tons on irrigated lands; cotton, .26 bale to the acre on non-irrigated and .39 bale on irrigated land. Not only is the average yield to the acre increased under irrigation, but greater assurance of an annual crop results. These facts insure the continuance of irrigation practices and increasing acreage is certain to be brought under irrigation methods of cultivation from year to year in Texas.

Texas farmers have sustained great losses from time to time as a result of floods. The State has many streams with low banks and wide fertile valleys that are subject to overflows in years of excessive rainfall along their upper courses. Most of these streams have their sources in those sections of the State where normal rainfall is inadequate to insure good crop yields annually. The problems of conserving flood

waters and reclaiming arid and semi-arid lands and, at the same time, preventing successive flood waters from inundating the rich valleys along the lower courses of the rivers have recently attracted statewide attention. The Legislature in January, 1923, passed a law appropriating $600,000 for the biennal period for the purpose of enabling the Board of Water Engineers and the State Reclamation Engineer to make a topographic and hydrographic survey of the stream watersheds of the State to the end that flood waters might be controlled and the water supply conserved for irrigation purposes.

It is believed that these surveys when completed will supply adequate information on which to base bond issues and the organization of improvement districts. It is contemplated that vast reservoirs can be constructed for the conservation of flood waters for irrigation and levees can be built along the lower courses of the rivers that will safeguard their fertile valleys from overflow. The number and length of these rivers and the aggregate area of their watersheds present a problem of gigantic proportions. It is not thought that the ultimate object of this enterprise will be accomplished in a few years. On the contrary, it is fully recognized by those responsible for the movement that it will require many years for even a substantial beginning of this task.

The reclamation and protection of swamps or land injured or threatened with water-logging and the concentration of salts, commonly called alkali, in the surface soil as a result of irrigation are probably of

importance to Texas agriculture. The nature of the problems of drainage differs in the several sections of the State. These enterprises in the eastern part are for the drainage and reclamation of land that is generally swampy or subject to overflow. In the counties bordering the Gulf of Mexico there are extensive areas so near the sea level that the meandering streams are too sluggish to drain the land. In several parts of west Texas, artificial drainage is used for the purpose of leaching out the alkali that has come to the surface as the result of irrigation.

The methods of artificial drainage include all varieties of underground conduits, pipes, tile, stone, wood or other materials, and some open ditches and canals. The last method is the most extensive one employed in Texas.

The drainage enterprises of Texas are conducted under the provisions of several acts that have been passed from time to time by the Legislature. The first drainage law of Texas was passed in 1895. This act provided for the establishment of drainage districts by the Commissioners' Courts on petition of five or more owners of land to be affected. Similar drainage laws were passed by the Legislature in 1897, 1899, 1905, 1907, 1911 and 1913. These several statutes modified in material respects the preceding statutes relating to the same subject. The office of State Reclamation Engineer was created under the provisions of the Act of 1913. This officer is charged with planning and laying out the improvement necessary to reclaim the swamps in overflowed

lands of the State suitable for agricultural purposes. This act also abolished the State Levee and Drainage Board and the office of the State Levee and Drainage Commissioner created by a previous act. The law requires that each drainage, levee, or improvement district shall file with the State Reclamation Engineer a complete record of its organization, plans, and estimates immediately prior to the approval of its bond issue by the Attorney General.

The drainage district law of 1911 supersedes the act of 1907. The present statute authorizes the establishment of drainage districts by the county commissioners' courts on petitions signed by twenty-five freehold resident tax payers, or from one-third of all such tax payers in the proposed districts. After the sufficiency of the petition is determined at public hearing, the commissioners' court appoints an engineer to make a survey and draw preliminary plans for the drainage districts. Public hearing is again held on the engineer's report. Before the district can be organized, the issue of bonds and levy of the drainage tax must be approved by a vote of two-thirds of the property tax payers at a special election. If the levee district is created and the bonds are issued, the county commissioners' court is empowered to appoint three drainage commissioners to administer the affairs of the district. These commissioners may be elected by the land holders of the district if a majority of the tax payers prefer this method of selection. The bonds of the district may not be issued for a longer period than forty years and must

be approved by the Attorney General of the State. The interest and sinking funds of the bonds are derived from taxes levied annually on all real, personal, and other property in the district. This law does not provide for organizing a drainage district located in more than one county.

The original drainage law of 1895 authorized the formation of drainage districts situated in two or more counties, and subsequent acts have not specifically repealed this provision.

The drainage district law of 1911 was amended in 1915 by providing for the maintenance of each drainage district. The drainage commissioners are required under the provisions of this amendment to submit an annual report to the county commissioners' court on the conditions of the district, with estimates for its maintenance. The commissioners' court is empowered to levy taxes on all property of the district sufficient to pay for the maintenance, provided the rate does not exceed one-half of one per cent of the assessed valuation. The funds derived therefrom are to be expended by the drainage commissioners for the maintenance of the project.

Under the various provisions of the statutes of the State relating to drainage, fifty-four operating drainage enterprises have been started with an average area of 40,113 acres. Of this number, thirty are of 10,000 to 50,000 acres each, and only eight are smaller than 10,000 acres each. There were 8,106, or 1.9 per cent, of all the farms of the State reporting land having artificial drainage in 1919. The total

acreage of land operating drainage enterprises was estimated at 2,166,128 acres, or 1.3 per cent of the total land area of the State. The capital investment in these enterprises was reported at $5,700,805 in 1919.

The principal drainage districts of the State are in the counties along the Gulf Coast, extending from Orange to Nueces County, most of them being in the counties of Harris, Galveston, Fort Bend, and Brazoria where the open ditch and canal system is generally the method that has been applied. Other important drainage districts are in Cameron and Hidalgo counties, and in Reeves and El Paso counties in west Texas.

Terracing is being increasingly practiced on Texas farms. A few years ago terraces on a hillside were rarely seen, but today they are in evidence on many farms in every part of the State where the lands are sufficiently hilly and subject to erosion. The early efforts at terracing were generally poorly done and, instead of preventing erosion of the soil, they often contributed to it.

Terracing involves a knowledge of farm engineering. Few practical farmers are sufficiently familiar with levels to keep them properly adjusted. Experience is required in running terrace lines and using proper methods of building terraces. Specialists from the Extension Service of the Agricultural and Mechanical College have devoted much time in recent years in assisting county agents to become proficient in terracing methods. Many demonstrations have been conducted in various places (sixty-one in

1922) and terrace lines were run over 980 acres. "In some sections," reads the annual report of the Extension Service for 1922, "terracing has been accepted as a part of the regular year's work, and at certain seasons of the year some time is given over to the upkeep of terraces already built, and to building new ones. This is very gratifying since one of the problems of successful terracing has been to get farmers to stay with it systematically. It might be mentioned in connection with terracing work, in East Texas especially, that farmers who have been working with terraces for any length of time are broadening their old terraces in order that they may cultivate them conveniently, and are planting velvet beans pretty regularly on the terraced land in an effort to rebuild it."

There is need in Texas for a constructive policy of land utilization. The areas of forest, grazing, and agricultural lands need to be determined and a policy of the best use of each area should be clearly formulated. The present yields of farm crops are too low. The prosperity of Texas farmers depends on a united effort to increase acreage yields of farm crops.

CHAPTER VI

AGRICULTURAL INDUSTRIES, PLANTS AND CROPS OF TEXAS

While vast areas in the plateau section and in the Trans-Pecos country are not adapted to agricultural production, nevertheless, Texas is a leading state in the yields and values of its crops. The fertility and variety of soils, and the wide range of climatic conditions—temperature and rainfall—make possible a tropical and semi-tropical plant production in the southern section and a plant growth of the temperate region in the northern and northwestern part of the State. Thus, within vast areas adapted to agriculture, cotton, corn, wheat, oats, rice, sugar-cane, tobacco, forage crops, vegetables, and fruits are successfully grown.

Texas leads the United States in the value of its field crops. It has ranked first among the states of the United States for the past four years, with the following values of its agricultural products:

Year	*Value of Products*
1922	$ 755,000,000
1921	424,471,000
1920	711,175,000
1919	1,071,527,000

The value of the 1919 crops represents the peak of production, not only for Texas but for any single

state in the history of the country. This was the year of highest prices for farm products and the fall in prices in subsequent years does not indicate a proportional decline in bulk production. The fact is, as every well informed person knows, the range of prices of the several farm crops from year to year makes it impossible to correlate aggregate farm values with the total yields of state crops.

Horticultural products of many varieties are produced in Texas. The varied climatic conditions make it possible to produce some horticultural product in almost every section of the State. No other state, in fact, is so peculiarly situated that it is possible to grow citrus-fruits in one region, apples in another and peaches in still another; and each of such quantity and quality as to make the crop of commercial importance.

COTTON

Cotton is one of the most important, if not the most important, article of the world's commerce. The great significance of this textile today in the agricultural, commercial, industrial, and social life of the people causes one to marvel that it was practically unknown to the civilized nations of western Europe two and a half centuries ago. It is true that the earliest explorers found cotton being cultivated and manufactured from the West Indies to Peru and from Mexico to Brazil when they first visited this country, but there is no record of plants being conveyed to Europe for more than two cen-

turies after explorations to the New World began. That the soil and climate of Texas are naturally favorable to cotton is indicated by the fact that De Vaca is reported to have found a wild cotton growing in Texas and Louisiana in 1536.[1]

While the American continent and the West Indies possessed wild and cultivated cottons independent of those of the Orient at the time of early Spanish discoveries of the New World, it is not known what influence these native cottons had on the development of the industry. The first attempt to grow cotton in the United States was in Virginia, but it was not until the second decade of the seventeenth century that systematic efforts were made to grow it, and then the seed was obtained both from the Levant and the West Indies. It was not until approximately a hundred years later that cotton plantations became of national consequence. Gradually the industry shifted from east to west as the importance of cotton production increased.

Previous to 1820 more than two-thirds of the cotton crop was grown on the Atlantic seaboard, but with the increasing importance of cotton culture the area was rapidly extended westward and soon the proportions were reversed. By 1830 64.4 per cent and by 1867 7.5 per cent of the cotton produced in the South was grown in the south-central and southwestern part of the country. The amount of cotton raised in Texas previous to 1840 was almost negli-

[1] See Watts' *The Wild and Cultivated Cotton Plants of the World.* Chapter I, p. 17.

gible, but the State produced 58,072 bales in 1850 and the number was increased to 431,463 bales in 1860. From this date onward, Texas rapidly advanced to first place as a cotton-producing state.

At the present time Texas leads all other states in the number of bales produced annually, and outranks every other country of the world in cotton production. The annual yields, however, vary considerably from year to year, due to climatic conditions, insect depredations, and the more or less effective cooperative efforts of farmers to adjust the supply of cotton to commercial demands. As cotton culture is more or less stable throughout the South, the ratio of yields between Texas and all other states is now fairly uniform, the total yield in Texas being from one-third to one-fourth that of the entire cotton-growing area of the South.

The following tabulation illustrates the comparison between the cotton production of Texas and that of the entire South in recent years:

Year	*Total Production of United States (bales)*	*Production of Texas (bales)*
1913	14,156,000	3,945,000
1914	16,135,000	4,592,000
1915	11,192,000	3,227,000
1916	11,450,000	3,726,000
1917	11,302,000	3,125,000
1918	12,041,000	2,697,000
1919	11,421,000	3,000,000
1920	12,987,000	4,345,000
1921	7,170,000	2,200,000
1922	9,964,000	3,290,000

The chief cotton-growing area of Texas lies within a triangle bounded by Gainesville, Texarkana, and San Antonio. (Fig. 7). However, cotton is pro-

FIG. 7.—Texas cotton crop.

duced in large quantities along the Gulf Coast and through large areas of west and northwest Texas. More or less cotton is grown in every section of the State, with the exception of the extreme southeast-

ern, along the Gulf Coast, in southwest Texas along the Rio Grande, in the Trans-Pecos country and some of the upper Panhandle.

The black land counties of north-central and north Texas are the largest cotton-producers of the State, although counties of unusual yields are rather well distributed over the cotton areas of Texas. Williamson and Ellis are the largest cotton-producing counties. The former yielded 154,355 bales and the latter, 127,378 bales in 1920. Milam county was a close third in that year with a yield of 122,309 bales. Other counties of unusually high production are Bell, with an annual yield of 94,667, bales; Hill, with 85,-612 bales; and Navarro, with 89,187 bales for the year 1920. Forty-one counties in Texas in 1921 each produced over 25,000 bales of cotton.

Yields to the acre fluctuate throughout the cotton belt from year to year. Soils, climate, and insect depredations are the principal influences in determining yields. Even on the same soils, annual yields vary considerably, due to extremes of climate and the relatively destructive effects of cotton pests and diseases. The Texas cotton farmer has experienced the effect of these influences from time to time and his prosperity is determined, to a large extent, by them.

The river valleys of Texas, especially along the courses of the larger streams flowing into the Gulf, are unusually well adapted to cotton production. Most of these river valleys are subject to disastrous floods and overflows which, from time to time,

have partially or completely destroyed the growing crops.

The soils of Texas vary within wide limits with reference to cotton culture and greatly influence the average yield to the acre. The most productive soils, under normal climatic conditions, are the dark colored clay lands that are rich in lime. The Black Prairies of Texas conform generally to this type. The Red Prairie soils and those of the Grand Prairie and the Edwards Plateau are also productive of good yields of cotton. The rich alluvial soils of the river valleys are unusually good for cotton production. In good years it is not exceptional to produce as much as a bale of cotton to the acre along the lower courses of these rich river valleys. The sandy uplands of many parts of Texas are also often planted in cotton, but the use of fertilizers is really necessary in most of these soil types to make cotton culture reasonably profitable.

Climatic conditions in Texas are generally favorable over wide areas, although the lack of uniformity in rainfall from year to year makes the cultivation of cotton more or less hazardous. The crop in Texas is rarely endangered by killing frosts. In general, the last frost occurs sufficiently early in the spring and the first frost late enough in the fall to give ample time for the planting, cultivation, fruiting, and harvesting of the cotton crop. Before the appearance of the boll-weevil, the farmers in the southern part of the cotton area of Texas depended somewhat on the result of a "top crop" which was

the last to mature. As this part of the crop matured rather late in the fall, it not infrequently happened that it was destroyed by frost, but, with this exception, killing frosts have not been a serious concern of the Texas cotton farmer.

The rainfall ranges from 23 inches in the cotton-producing areas of west Texas to 30 to 60 inches in the southern and eastern sections. The yields are greatly influenced by the spring rains as this is the growing season of the cotton plant. The spring rains range from 6 inches in west Texas to 16 inches in other sections. In the Black Prairie regions of central Texas the amount of rainfall averages about 8 inches. An extremely dry spring or a wet summer is detrimental to the growing and maturing of cotton. The lack of uniformity of rainfall in the spring and summer months and the wide differences in normal rainfall in the different sections of the State greatly influence the total cotton production from year to year.

The largest average yield for any one year, as reported by the United States Department of Agriculture,[1] was in 1898 when 220.6 pounds to the acre were reported. The year of second largest yield was in 1914 with an average of 209.2 pounds to the acre. While the total acreage of the cotton belt has greatly increased in recent years, there has been a more or less general decline in the yield to the acre. The following table indicates this tendency:

[1] Year Book of U. S. Dept. Agr. (1921), p. 610.

ACREAGE AND YIELD TO THE ACRE OF COTTON IN THE UNITED STATES IN RECENT YEARS

Year	Average (000 omitted) Acres	Average Yield to the Acre in Pounds
1913	37,089	182
1914	36,832	209.2
1915	31,412	170.3
1916	34,985	156.6
1917	33,841	159.7
1918	36,008	150.6
1919	33,566	161.5
1920	35,878	178.4
1921	30,509	124.5
1922	33,742	141.6

The acreage and yield to the acre in Texas for the same period as that in the tabulation above are interesting from the standpoint of comparison.

ACREAGE AND YIELD TO THE ACRE OF COTTON IN TEXAS IN RECENT YEARS

Year	Acreage (000 omitted)	Yield to the Acre in Pounds
1913	12,597	150
1914	11,931	184
1915	10,510	147
1916	11,400	157
1917	11,092	135
1918	11,233	115
1919	10,476	140
1920	12,576	160
1921	10,961	96
1922	12,125	130

It will be observed that the yield to the acre in Texas is uniformly below the average yield for the United States, with the exception of the year 1916.

This is not due to the relatively unfavorable natural conditions for cotton culture in Texas. The principal causes are traceable to the continuous cultivation of cotton year after year on the same land or to an unscientific and poorly adapted cropping system. The low average yields are influenced also by the limited use of fertilizers on thin soils and the gradual extension of cultivation to areas not well adapted to cotton, or to sections where climatic conditions make high average yields rather uncertain. Texas was also the first state of the cotton belt to experience the damaging effects of the boll-weevil, which partially explains the disparaging yields in Texas before this pest spread to the other cotton-producing states.

The recent tendency of farmers to plant improved varieties of cotton seed will certainly partially offset the influences resulting in low yields and increase the average yield within the next few years. There are numerous cultivated varieties of cotton differing in plant character, as well as in length, strength, and fineness of fiber. A number of these have been developed and adapted to Texas conditions in recent years. Thirty-eight principal commercial types of cotton are recognized by Liverpool, which is the most important cotton market of the world. These types differ greatly in texture and, therefore, in commercial value. The cotton farmer in Texas has realized very recently the importance of planting a variety of seed that will give his product a high commercial value in the markets of the world.

The value of cotton depends principally on the length and character of the staple. Commercially, all cotton is divided into two classes—short-staple and long-staple. "Short-staple" is the term applied to the fiber whose length is one and one-sixteenth inches or less; "long-staple" is the fibre whose length is one and one-eighth inches or over. The length and strength of the fiber depend on the variety of seed planted, the soil, prevailing climatic conditions, and the cultural methods applied.

Short-staple cotton is grown throughout the cotton belt and comprises on an average 92 per cent of the entire crop. The length of the fiber of short-staple varies from three-fourths to one and one-sixteenth inches. On the sandy or other poorer soils of Texas the staple is often less than seven-eighths of an inch, while on the rich bottoms or the Black Prairies the staple often exceeds an inch in length and usually has a characteristic, strong, hard staple.

Upland varieties of long-staple cotton with fiber ranging from one and one-eighth to one and three-fourth inches are not planted extensively in Texas. Most of the long-staple cotton is grown in the Pecos and Red River valleys. The total amount of long-staple cotton produced in the United States was 850,000 bales in 1919, and 1,112,000 bales in 1920. Of this Texas raised only 177,000 bales in 1919, and 230,000 bales in 1920. There is likely to be some extension of the long-staple area in certain sections where irrigation methods may be applied.

The enemies of the cotton plant are rather nu-

merous and the Texas farmer has felt their effects. The menace of some of these pests has created considerable uncertainty as to the future of cotton production in the South.

The principal destructive pest is the boll-weevil, which seems to have appeared first in the plateau region of Mexico. With the increased production of cotton in Mexico this insect rapidly spread throughout the cotton-growing region of that country. The boll-weevil first appeared in Texas near Brownsville in 1892. In the next two years it spread to several counties in southern Texas. Since that time it has rapidly spread its range not only throughout Texas but, in more recent years, throughout the cotton belt. While the destructive effects of the boll-weevil have not been uniform from year to year, the losses incident to its ravages have been enormous. In years of unusual infestation the damage may run as high as 50 per cent or more of the crop and result in great financial loss and distress to the cotton planters. A very mild winter is almost invariably followed by a heavy weevil infestation with correspondingly large losses in yields. Excessive rainfall during the fruiting season is also responsible for unusual weevil activity.

For many years little progress was made in methods of controlling boll-weevil infestations, but recently increased efforts are being exerted to reduce the damage from this insect. It is now generally admitted that the boll-weevil can not be eradicated, but it is the increasing belief of entomologists fa-

miliar with this pest that control methods will probably come to be increasingly effective. For example, the application of calcium arsenate in dry dust form when properly applied to the growing cotton plant is rather effective in destroying the boll-weevil. Other control measures are also being adopted, including the destruction of cotton stalks in the fall, either by burning or by plowing them under, thereby destroying the hibernating places of the weevil. The use of early maturing varieties of cotton will result in maturing the cotton bolls before the heavy infestation of the weevil appears.

The problems of the Texas cotton farmer were further complicated by the appearance of the pink boll-worm in 1917. Attention was first called to this pest by an English entomologist in 1842 when it first appeared in India. The pink boll-worm was found in Egypt in 1911. Through two importations of cotton seed from Egypt the pink boll-worm was introduced into Mexico where its existence did not become known to American entomologists until 1916. An effort was made to prevent the spread of the worm to Texas by placing an embargo on Mexican cotton seed, but before this took effect large quantities of seed from Mexico were shipped to several cottonseed oil mills in Texas. The first infestation in Texas was in a cotton field near Hearne. Subsequently the pink boll-worm was found in several places along the Mexican border, in south Texas and in one or two localities in Louisiana. However, due to the vigorous efforts of the entomologists of the United

States Department of Agriculture in cooperation with state agricultural authorities, the actual infestations in Louisiana have been completely stamped out and those in Texas have either been eradicated or greatly reduced.

The cotton boll-worm and leaf-worm are two other enemies of the cotton plant that are familiar to the farmer. The boll-worm appeared long before the advent of the boll-weevil and it is one of the most widely distributed and most destructive injurious insects. The damage from the cotton boll-worm varies greatly from year to year and control methods, especially the application of calcium arsenate to the plant, are reasonably effective. The cotton leaf-worm has been known from the earliest days of cotton culture in this country. Its ravages are apparent during the late growing season of the plant, due to its stripping the leaves of the cotton. This insect is easily controlled by the application of calcium arsenate.

Cotton wilt, Texas root-rot, root-knot, rust, anthracnose, and angular leaf-spot or bacterial blight are more or less familiar diseases of the cotton plant. These are not equally destructive or injurious in all places in Texas, but in one or the other sections they do affect the successful cultivation of cotton. Plant pathologists connected with the Agricultural Experiment Station of the Agricultural and Mechanical College of Texas and other scientists have studied the causes and remedies connected with these diseases and considerable progress has been made in reducing their destructive effect.

It is difficult to predict the future of cotton production in Texas. Cotton is now grown in 224 of the 250 counties and it is not likely that the area will be greatly extended. On the other hand, the tendency to diversify is rapidly increasing. This had its substantial beginning in earlier years when the ravages of the boll-weevil were most destructive and, with increasing control measures against insect depredations and cotton diseases, it continues to increase. Probably the counteracting influences of diversification on the one hand and the tendency to plant better varieties of seed and the application of more scientific methods of cultivation on the other, will result in maintaining the total production not widely different from that of recent years.

GRAIN CROPS

The leading grain crops of Texas in the order of their importance are corn, wheat, oats, and rice. Some barley and rye are also grown.

Geographically, Texas does not come within the corn belt, but corn has been raised in increasing quantities since the beginning of the Colonization Period in 1821 by American settlers. In fact, maize or Indian corn was grown by the more domestic Indian tribes, such as the Cenis, Nassonis and Caddo, in considerable quantities at the time the Spanish explorers first entered the country. Corn, according to Harshberger, probably originated in Mexico and was first cultivated in that country on the upper

plateau regions as early as the beginning of the Christian era. According to this authority, maize was first brought across the Rio Grande about 700 A.D. If this view is correct, corn was probably first cultivated in the present territory of the United States on Texas soil and in the course of the next two or three centuries its cultivation gradually extended across the continent to the Atlantic seaboard and up the coast to New England. "Indian corn," says Bowman, "entered into the mythology and religious ceremonies of the Indians, both of North and South America, long before they were disturbed by civilization. When the white man came to live among them they taught him how to select the best ears for seed and how and when to plant it." [1]

The early settlers adopted the methods of the Indians in the cultivation of maize. The squaw, who did most of the work, planted the grain in the spring. Holes, about four feet apart, were made in the ground with a sharp stick. A fish or several crawfish were placed in each hole for fertilizer. The seed were then planted and covered with soil. The corn was harvested in the fall and stored away in pits dug in the ground.

Although maize or Indian corn seems to have entered its present territory through the southern region of the present state of Texas, due to the earlier settlement of other sections of the country, corn was first cultivated by the English colonists along the James river in Virginia in 1608. As early as 1650

[1] See *Corn*, p. 2.

about 600 bushels were exported from Savannah, and by 1670 more than 13,500 bushels were shipped from this port. From this time on, the acreage in corn increased rapidly through the colonies and there was a corresponding increase in corn production.

Corn is now grown in every state in the Union, but not with equal success. It has been demonstrated that the best soil and climatic conditions for corn production are in the vast area of the Middle West, known as the corn-belt. This region may be described roughly as extending from southern Ohio to southeast South Dakota, and thence southeast along the Mississippi. There are many other restricted areas, more or less widely separated, where corn produces comparatively large average yields and comprises an important field crop. The total acreage and the average yields of corn entitle Texas to inclusion in this secondary corn area, although the State does not measure up to the production standards of the corn-belt.

Corn was grown for grain on 341,313 of the 436,033 farms in Texas in 1919, according to the United States census figures of 1920. On the basis of total number of farms on which corn is grown, Texas heads the list, due to the greater number of farms in Texas than in any other state. The percentage of farms on which corn was grown in 1919 was 73.3, which is exceeded by a number of states. However, the percentage of farms in Texas growing corn for grain is about the average for the nation as a whole. The last census reports that corn was grown on 4,936,-

692 of the 6,448,343 farms of the United States, which is approximately 75 per cent of the total number of farms.

The relative importance of Texas as a corn-growing state may be indicated roughly in the following comparison:[1]

ACREAGE, PRODUCTION AND TOTAL FARM VALUE OF CORN IN 1921 (BASED ON PRELIMINARY ESTIMATES OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, DECEMBER 1, 1921).

State	*Acreage (000 omitted)*	*Production (000 omitted)*	*Value in Dollars (000 omitted)*
Iowa	10,330	444,190	133,257
Illinois	8,999	305,966	116,267
Nebraska ...	7,419	207,732	56,088
Missouri ...	6,096	182,880	73,152
Indiana	4,718	169,848	62,844
Ohio	3,886	159,326	65,324
Texas	6,227	156,920	84,737

Based on total production, Texas stands seventh as a corn-producing state, but this high relative position is due to the fact that in 1921 approximately one-fifth of the improved land in farms was planted in corn. A closer approximation of the State's relative importance as a corn-producer may be indicated by a comparison of average yields of corn to the acre. On this basis Texas stands relatively low. The following tabulation for the seven states listed above will bring out this comparison:[2]

[1] Figures taken from Yearbook of U. S. Dept. Agr., 1921, p. 510.

[2] Opus Citus, p. 512.

ACREAGE YIELD OF CORN TO THE ACRE FOR PERIOD AND YEARS INDICATED

State	5-yr. Average 1917-1921	1917	1918	1919	1920	1921
	Yield to the Acre (Bushels)					
Iowa	40.7	37	36	41.6	46	43
Illinois	35.6	38	35.5	36	34.6	34
Nebraska ...	26.5	27	17.7	26.2	33.8	28
Missouri	28.8	35	20	27	32	30
Indiana	36.5	36	33	37	40.5	36
Ohio	40.3	38	36	43	43.4	41
Texas	20.4	11	10	30	26	25.2

This table reveals several facts of interest which may be summarized as follows: (1) There is considerable variation in the average yields of corn to the acre from year to year, even in the best producing states. (2) The general average for 1920 was relatively high for all the states listed.[1] (3) The five-year average and the average by single years are highest in the central states of the corn-belt. (4) In contrast with these high averages, Texas shows a comparatively low five-year average and a very low one for the single years of the period.[2]

[1] In fact, the 1920 crop of corn of the United States was the largest ever harvested. Although prices were relatively low, the aggregate value of the crop was estimated at $21,150,000,000. (See Yearbook, U. S. Dept. Agr. for 1921, p. 164.)

[2] The New England states maintained a higher five-year average yield and, on the whole, a higher average yield for the several years in the tabulation above than any other section of the United States. (See Yearbook U. S. Dept. Agr., 1921, p. 512.) This is due to the use of fertilizers, more restricted and better adapted soil types for corn, and more intensive methods of cultivation.

Soil and climatic conditions in Texas favorable to the production of corn are more restricted than those for cotton. The practice of farmers to maintain a simple rotation of cotton with corn has resulted in the planting of corn on some soil types not well adapted to it and in areas where climatic conditions are not the most favorable to high yields. This tendency has brought the average yield of corn to the acre down to a low figure, and made production unprofitable in some sections.

The Coastal Plain region, on the whole, is not well adapted to corn because the soil is deficient in vegetable matter and mineral plant-food. Much of the sandy hill land of east Texas, as a result of erosion, is equally undesirable for the raising of corn.

The profitable cultivation of corn in Texas is also restricted by climatic conditions. The essential requirement of a rather high well distributed rainfall, a large amount of sunshine, and a relatively high temperature during the growing season, is a combination of climatic factors that does not occur in Texas from year to year over wide areas with sufficient regularity to insure high average corn yields. However, in varying degrees the combination of these factors does exist, and an effort to cultivate corn is being made by farmers from southwest to northeast Texas, and from south-central Texas to the Red River.

Corn is grown rather successfully in the Black Prairie region of central and north Texas, and in

the rich valley lands that are well drained. Corn is also raised in considerable quantities on the hill lands of central, east, and northeast Texas where soil-foods have been reasonably well conserved. There were thirty-five counties in Texas, as reported by the United States census of 1920, that produced in excess of one million bushels of corn in 1919. Four counties—Bell, Fannin, Milam and Williamson —each yielded in excess of two million bushels. Included in the list of thirty-five counties producing more than one million bushels in 1919 are several east Texas and northeast Texas counties where a partial deficiency in soil-food has been overcome by rather unusually favorable climatic conditions. It is likely that the average yield of corn in a number of east Texas counties will be increased in the future as a result of a growing tendency on the part of farmers to use fertilizers, as well as to adopt a more scientific cropping system.

Corn will continue to be an important crop in Texas. In many sections where cotton is extensively grown, corn, along with oats or wheat, followed by cowpeas, will be a definite cereal in the cropping system. While the corn acreage in Texas is not likely to be extended greatly, a better cropping system, the more extensive use of fertilizer, better methods of cultivation and more adequate insect control will insure a higher average yield to the acre and correspondingly increase the aggregate production of the State.

Wheat is not grown over so wide an area as corn,

but it is an important crop in Texas. The fourteenth census reports wheat on 63,217 farms in 1919, which is only 14.5 per cent of the total number of farms in the State. The total acreage in wheat was 2,414,903 in 1919. The number of farms on which wheat was planted and the total acreage have greatly increased in recent years. For example, there were only 6,825 farms, a total of 440,001 acres, in wheat in 1909. The acreage in wheat in 1920 was 1,583,000, and in 1921, 2,081,000.

While the acreage in wheat has greatly increased recently, there is considerable fluctuation from year to year. There are several causes for this variation. The black waxy lime land of north-central Texas, where wheat is principally grown, is also well adapted to high yields of cotton. The relative acreage planted each year in cotton or wheat is influenced by prospective prices and climatic conditions. Relatively high prices, or prospective high prices, of wheat tend to increase the acreage and correspondingly decrease that in cotton, and *vice versa*.

The acreage from year to year is also influenced by climatic conditions during the planting season. Winter wheat constitutes almost the entire acreage for grain crops. Unless conditions are favorable for the preparation of the seed-bed and unless there is adequate rainfall about the seeding time to bring the crop up, it is probable that the cropping plan will be changed and the land rebedded and later planted in cotton.

The relative increase in the acreage of wheat in

Texas in recent years has been due to the gradual extension of the wheat area. According to the fourteenth census, twenty-nine counties of Texas produced more than a half-million bushels of wheat in 1919. Three counties—Denton, Carson, and Gray—each raised more than a million bushels. Gray, the largest producing county for 1919, and Carson counties are in the Panhandle section, while Denton county, the second largest producer, is in the black land region of north-central Texas. The northwestern part of the State has developed rapidly as a wheat-growing section. This is especially true of the group of counties in the eastern part of the upper Panhandle and the counties to the southeast in the lower Panhandle.

The average yield of wheat in Texas compares favorably with most states in the Union. The five-year average (1917-1921) was 13.3 bushels to the acre. This is approximately the general average of the United States for the same period, although the five-year average for a number of states exceeds this figure. For example, the five-year average for Arizona was 24.2 bushels; that of Nevada, 24.1; and that of Idaho, 21.3 bushels. The highest average yield for any one year in Texas was in 1919, when 16.5 bushels to the acre were produced.[1] The average yield of wheat to the acre in Texas varies considerably from year to year.

The yields of wheat are influenced by extremes of climatic conditions, insect pests, and fungous

[1] Yearbook of the U. S. Dept. Agr. for 1921, p. 528.

diseases. The chinch-bugs are responsible for considerable losses to wheat-growers in Texas, although the ravages of this insect are not equally destructive from year to year. Rusts and smuts also affect the wheat crop in some sections, especially in years when climatic conditions are unfavorable. Control methods are being adopted and disease-resisting varieties of wheat planted as a means of insuring larger yields.

Most of the wheat raised in Texas, like that of the entire wheat-growing section of the cotton-belt, is of the soft, or semi-hard, red winter type. In north-central Texas varities of both the hard red winter wheat, belonging to the Turkey or Crimean type, and the soft or semi-hard kinds are grown. The principal varieties of beardless soft winter wheat planted in Texas are the Fultz, Poole, German Emperor, and Michigan Amber, and the bearded varieties are the Mediterranean and the Fulcaster. The hard winter wheats are the bearded varieties known as Defiance, Kharkof, Turkey, and Crimean.[1] Durum wheat, whose bearded heads resemble barley, is raised in small quantities in northwest Texas. One variety is known as Nicaragua wheat. The high gluten-content and the great density of this wheat make it valuable as a flour from which macaroni is made.

These varities are not equally popular or profitable. The qualities most desired in wheat are high yields,

[1] See J. O. Morgan's *Field Crops for the Cotton Belt*, Chapter 26, p. 321.

disease resistance, high protein-content, and early maturity. The comparatively mild winters in parts of the wheat-growing sections of Texas influence both the yields and quality of the wheat. The most popular varieties of wheat grown in Texas under reasonably favorable climatic conditions contain sufficient gluten and other qualities to give them value for milling and utilization for bread-making.

Oats are grown over a larger area in Texas than wheat, but the average acreage to a farm is relatively smaller than that normally planted in wheat. The fourteenth census reports oats on 95,783 farms in Texas in 1919, which was 22 per cent of the total number of farms in the State. Three times as many farms were growing oats in 1919 as reported oat crops in 1909.

The acreage in oats increased from 440,001 bushels in 1909 to 1,862,933 bushels in 1919. The acreage dropped to 1,490,000 in 1920, and rose to 1,863,000 in 1921. Texas stood seventh in the total acreage in oats in 1919, having been exceeded only by the states of Iowa, Illinois, Minnesota, Wisconsin, North Dakota, and Nebraska.

Texas stands low in comparison with other states in the average yield of oats to the acre. The average for the five-year period from 1917 to 1921 was 24.5 bushels. The highest for any one year during this period was in 1919 when the State produced an average of 42 bushels to the acre. The lowest average yield of any single year during this period was 14.7

bushels in 1918. While Texas compares favorably with other southern states in the average yield of oats, it produced seven bushels below the five-year average (1917-21) for the entire country.

Comparatively little attention has been given to the improvement of seed oats in comparison with corn and wheat. The low average yields in Texas, as well as in other southern states, are largely due to this cause. Only a few varieties of oats are grown in the State. Three varieties are well known: (1) the Red Rust-proof type known as Texas Red Rust-proof, Texas Red, or Red Texas, (2) Burt or May oats, and (3) Turf or grazing oats. The planting of one or the other of these varieties depends on the use that the farmer intends to make of this grain crop.

Oats are grown for grain over a wide area from the southwest, through the central portion of the State, to the northeast. However, in many parts of the territory oats are an uncertain crop, due to climatic conditions, and often are used as hay or for pasture and soiling. In the Gulf Coast section oats are usually raised for pasture or for hay. In the north-central part of the State oats are grown in considerable quantities as a grain crop.

While the cultivation of rice in Texas is comparatively recent, the production is larger than any other state in the United States, with the exception of Louisiana. The acreage and production of rice in Texas are approximately one-third that of Louisiana.

Rice was cultivated from early Colonial times in the swamp lands of the South Carolina and Georgia coasts. While much of the land along the Gulf Coast is similar to that in these two states on the eastern seaboard, little effort was made to produce rice in Texas previous to 1890. The earliest rice-producing section was near the Gulf Coast in the vicinity of Beaumont and along the lower Colorado River Valley. Rice-growing in this section has been extended. It is now raised along the Gulf Goast from the Louisiana line to the Guadalupe River, embracing the counties of Orange, Jefferson, Chambers, Liberty, Galveston, Harris, Brazoria, Fort Bend, Waller, Matagorda, Wharton, Colorado, Austin, Jackson, Calhoun, Victoria and Dewitt. Some rice is grown on the irrigated farms along the lower Rio Grande valley in Cameron County.

The fourteenth census reports 5,306,369 bushels of rice raised on 164,481 acres in 1919. Jefferson County had an acreage of 42,939 and a production of 1,462,648 bushels in that year, which was the largest producing county in the State. Matagorda County stood second, with an acreage of 37,927 and a production of 986,373 bushels. In 1920, 281,000 acres were planted in rice and the total production was 9,554,000 bushels. The acreage in 1921 was reduced to 155,000, and the total production dropped to 5,596,000 bushels. This decline in acreage and production was due to economic conditions of a temporary nature. Under normal conditions the acreage will be restored and in the future the area along

the Gulf Coast planted in rice will probably be extended and the production correspondingly increased.

The five-year average yield of rice (1917-1921) in Texas is reported at 32.8 bushels. The average yield of rice to the acre compares favorably with that of the other rice-growing states of the South, with the exception of Arkansas whose production over the five-year period exceeded 45 bushels to the acre.

The Honduras and Japan varieties of rice are extensively grown in Texas. The most important variety is known as Blue Rose. This was originated by a planter by the name of Wright, of Crowley, Louisiana. It has proved to be high yielding and possesses excellent milling qualities. The rice experiment station of the Agricultural and Mechanical College of Texas, located at Amelia in Jefferson County, has introduced a number of new varieties of rice from the Philippine Islands. Several of these give promise of high yields and good grain qualities. Fertilizer tests with sulfate of ammonia are being made at this experiment station for the purpose of determining the best means of increasing the yields of rice.

Water for irrigating rice is supplied from bayous, rivers, and wells, from which it is pumped into main canals and supplied by laterals to the fields. The water is lifted into the canals by centrifugal pumps. The large areas of level prairie lands along the Gulf Coast of Texas and the abundant source of water

PLATE VI. A field of kafir showing the prolific growth of this crop in west Texas.

greatly reduce the cost of cultivating rice and insure its permanence.

Large areas along the Gulf Coast well adapted to rice remain uncultivated. The rice farmers have experienced some difficulties in recent years that have retarded the development of the industry. There are important problems of cultivation, harvesting, and marketing that need to be solved before there will be a great extension of the area of rice farming. The research agencies of the Agricultural and Mechanical College of Texas are interested in the solution of these problems, and undoubtedly their investigations will result in making rice culture more profitable and, therefore, increase the acreage and production in the State.

Barley and rye are relatively unimportant crops in Texas, but during the past ten years there has been an increase in the acreage of both these grains. Barley, however, is grown more extensively in Texas than rye.

The fourteenth census reports 77,780 acres of barley planted on 5,848 farms in 1919. The total yield for that year was 2,188,250 bushels. The figures of the United States Department of Agriculture for 1920 and 1921 estimate the production for these years somewhat below that for 1919. The five-year average production (1917-1921) was reported at 23.8 bushels to the acre. Most of the barley grown in Texas is largely for pasturage and soiling.

Rye, according to the fourteenth census, was only grown on 1,475 farms in 1919, and the production

was only 215,385 bushels. The acreage for 1920 and 1921 was approximately 13,000, with a production between 150,000 and 200,000 bushels. The five-year average yield (1917-1921) was 12 bushels to the acre. Rye, like barley, is principally grown for pasturage and soil improvement in Texas.

PEANUTS

Peanuts are grown rather extensively as a field crop in many sections of the State. The acreage has been greatly increased in recent years. The light sandy soils of Texas are generally well adapted to peanut culture. Texas was exceeded only by Alabama and Georgia in the acreage planted in 1921, and only by Alabama in 1922. The State produced 123,825,000 pounds of peanuts in 1921, and 96,320,000 pounds in 1922. The State's production was exceeded by Virginia, North Carolina, Georgia, and Alabama in 1921, and only by North Carolina and Alabama in 1922.

HAY AND FORAGE CROPS

According to the fourteenth census, Texas stands fifteenth among the states of the Union in the acreage and tonnage of its hay and forage crops. The acreage in 1919 was reported at 2,390,457, with a production of 3,729,651 tons. The value of this crop was estimated at $73,329,319. These figures include not only hay crops but corn, grain sorghums

cut for silage and fodder and root-crops used for forage.

The census classifies forage crops as follows: (1)

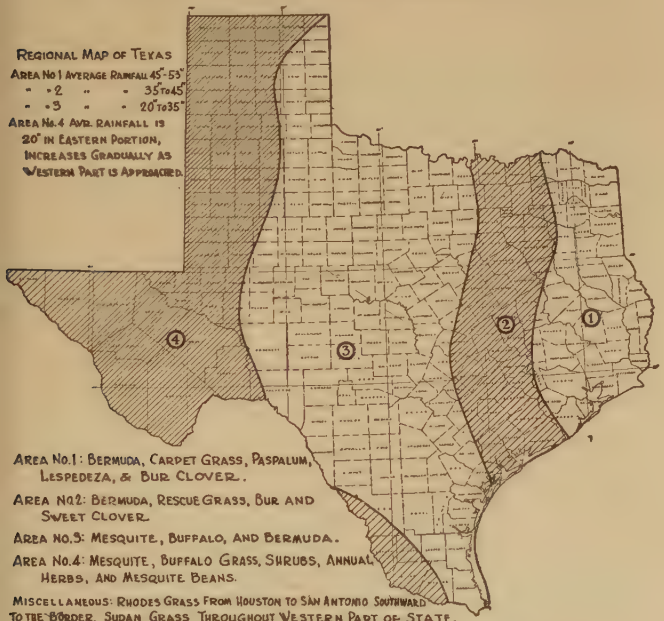
REGIONAL MAP OF TEXAS
AREA No 1 AVERAGE RAINFALL 45"-55"
" "2 " " 35"TO45"
" "3 " " 20"TO35"
AREA No.4 AVR. RAINFALL IS 20" IN EASTERN PORTION, INCREASES GRADUALLY AS WESTERN PART IS APPROACHED.
1
2
3
4
AREA No.1: BERMUDA, CARPET GRASS, PASPALUM, LESPEDEZA, & BUR CLOVER.
AREA No2: BERMUDA, RESCUE GRASS, BUR AND SWEET CLOVER.
AREA No.3: MESQUITE, BUFFALO, AND BERMUDA.
AREA No.4: MESQUITE, BUFFALO GRASS, SHRUBS, ANNUAL HERBS, AND MESQUITE BEANS.
MISCELLANEOUS: RHODES GRASS FROM HOUSTON TO SAN ANTONIO SOUTHWARD TO THE BORDER. SUDAN GRASS THROUGHOUT WESTERN PART OF STATE.

FIG. 8.—Distribution of grasses in Texas.

wild, salt or prairie grasses, (2) tame or cultivated grasses, (3) small grain cut for hay, (4) annual legumes cut for hay, (5) silage crops, (6) corn cut for forage, (7) kafir, (8) sorghum, and the like.

The principal wild grasses cut for hay are grown in southeastern Texas and over a narrow area extending from north to south, through east-central Texas. The total "wild, salt and prairie hay," using the phraseology of the census designation, was 188,002 acres, with a yield of 221,362 tons in 1919. The wild or prairie hay crop of the State in 1921 was estimated at 203,000 acres, with a yield of 223,000 tons.

"Tame or cultivated" grasses grown for hay in Texas are principally the Bermuda, Sudan, and Johnson. Some millet is also planted as a forage crop. The fourteenth census reports that the State harvested 527,924 tons of tame hay in 1919 from 326,206 acres. The acreage increased to 639,000, and the production to 882,000 tons in 1921. The value of this crop was estimated at $8,732,000 by the United States Department of Agriculture.[1] Tame or prairie grasses may be grown over almost the entire area of Texas, except the extreme western part, but the production varies between rather wide limits, depending on the varieties and the climatic conditions, especially during the harvesting season (Fig. 8).

"Annual legumes cut for hay" was a new item in the fourteenth census schedule. It includes cowpeas, soybeans and peanuts cut for hay. Most of the hay classified under this designation and grown in Texas consists of cowpeas and peanuts. According to the last census, the legume crops cut for hay were

[1] See Yearbook of U. S. Dept. Agr. for 1921, p. 596.

grown on 57,174 acres and produced 51,859 tons of feed.

While alfalfa is a legume, it was separately classified as a forage crop in the last census. Texas produced 137,043 tons of alfalfa on 53,268 acres in 1919. Alfalfa is becoming an increasingly important crop in the irrigated and sub-irrigated sections of west Texas. It is dependable on land which is naturally sub-irrigated. There are thousands of acres of such land in Dickens, Crosby, Motley, Floyd, and Hale counties, known as "draws," or slight depressions through which, in time of rainfall, water flows and is absorbed into the soil. This soil is usually very rich and has a considerable content of lime, which is essential to profitable alfalfa production. Most of these soils are Permian drift formations and have been eroded to a large extent. They are reddish, or chocolate, in color. These soils are naturally inoculated with bacteria favorable to the growth of alfalfa.

The agricultural experiment sub-station of the Agricultural and Mechanical College at Spur has been largely responsible for the growing of alfalfa in that section. Superintendent R. E. Dickson, of this station, was impressed with the need for a tame legume for his immediate section and his experiments proved so successful that farmers throughout the region who had land adapted to alfalfa began its cultivation. The results have been remarkably satisfactory. One farmer near Spur in 1922 produced 1,203 bales of alfalfa on eight acres, and

sold it at a dollar a bale, or $35 a ton, at his local market. Several cuttings of alfalfa are made each year and often it is used temporarily for grazing hogs.

Alfalfa is also grown profitably in the irrigated sections of the country, like that of the Toyah Valley at Balmorhea, in Pecos County. Under normal conditions the yield is large and, when prices are fair, the raising of alfalfa is a very profitable industry.

The most important of all the forage crops in Texas are the grain sorghums. The first seed were brought to this country from the Orange River Colony of South Africa, where two varieties were grown by the Kafir tribes in Natal. Grain sorghums were first introduced into west Texas about 1887. The State produced 2,474,511 tons of grain sorghum on 1,496,763 acres in 1919. In other words, two-thirds of the forage crops of the State for that year were grain sorghums, which were raised on slightly more than half the total acreage planted in forage crops.

The United States Department of Agriculture reports that grain sorghums are grown in profitable quantities in ten states. The three largest producers in the order of their importance are Texas, Oklahoma, and Kansas. The relative importance of grain sorghums as a forage crop may be indicated from the following tabulation:[1]

[1] Taken from figures contained in the Yearbook of the U. S. Dept. Agr. for 1921, p. 641.

ACREAGE, ACREAGE YIELDS, PRODUCTION AND FARM VALUE OF GRAIN SORGHUMS IN THE THREE HIGHEST PRODUCING STATES IN 1920 AND 1921

States	Thousands of Acres		Average Yields in Bushels to the Acre		Production (Thousands of Bushels)		Farm Value (Thousands of Dollars)	
	1920	1921	1920	1921	1920	1921	1920	1921
Texas....	1906	1950	32	29	60,992	56,550	73,800	23,186
Oklahoma.	1950	1240	26	21	35,100	26,040	21,060	7,812
Kansas....	1194	858	22	21.3	26,626	18,361	18,372	6,243

West Texas produces approximately 60,000,000 bushels of grain sorghums annually, which is about one-half of all the grain sorghum raised in the United States, and a little more than one-fourth as much as the corn grown in Texas.

Kafir has been the leading grain sorghum, but it is rapidly giving way to milo and feterita which are most dependable. Kafir and feterita are used more extensively as bundled feed for home use. Milo is the only member of the grain sorghum family that is marketed to any considerable extent. In west Texas about 75 per cent of the grain sorghum is milo, and about 12½ per cent each of kafir and feterita. Both milo and feterita possess early maturing qualities and, in general, are more resistant to drought than kafir. The class of grain sorghum known as "milo" comprises two principal varieties, the yellow and white; and each of these is composed of a dwarf and a standard sort.

The dwarf yellow milo is perhaps the best producer, although dwarf white milo has yielded well in some sections of west Texas. Both the standard yellow and the standard white are late in maturing, which is usually detrimental to high yields.

The feteritas consist principally of two varieties, known as the Spur and the unimproved. The Spur feterita, developed by R. E. Dickson, Superintendent of the branch agricultural experiment station located at Spur, has been found, in tests throughout the greater part of west Texas, to be a superior producer of grain.

The kafirs include the red and the white. Some individual growers prefer red kafir for forage purposes, but the white is more generally grown. Two varieties of white kafir are common, the standard Blackhull, which grows about 5½ feet in height, and the dwarf, which attains about 4½ feet. Dwarf white kafir, of which there are two strains known as Dawn and Sunrise, the original selections of which were made by A. H. Leidigh, of the Texas Agricultural Experiment Station system, at the Amarillo Field Station at Amarillo, Texas, yields better grain under limited moisture conditions than the standard Blackhull, although in that section of west Texas bordering the corn-belt the latter variety is a good producer.

The improved varieties of grain sorghums originated at the branch experiment stations at Spur and Lubbock have increased the yields and resulted in standardizing several of these grain types. The acre-

age yield of grain sorghums in Texas in 1919 was 33 bushels, as compared to that of 30 bushels of corn, notwithstanding that in many sections unimproved and considerably low yielding varieties were planted extensively. The experiments of these stations are being continued from year to year under the immediate direction of the local superintendent and the agronomists at the main station at the Agricultural and Mechanical College. The possibilities of increased production of grain sorghums in Texas are practically unlimited because of the large area in the western part of the State adapted to the crop and the ease with which great acreage production can be secured by the use of standard and improved varieties.

Sudan grass is an annual sorghum that has become increasingly popular in Texas in recent years. It is used for hay, pasture, soiling, and seed. Because of its close resemblance to Johnson grass it was at first mistrusted by many farmers, but it is distinctly an annual and never develops the underground rootstock which is the chief objection to Johnson grass. It grows from two to six feet in height when broadcast or close drilled. If planted in cultivated rows and allowed to mature, it frequently reaches a height of six to ten feet. Two or four cuttings of hay are produced in a season, depending on the rainfall and the time of seeding. Yields of two to six tons of hay to the acre are not unusual in west Texas. It is very drought-resistant, a rapid grower, and has remarkable qualities of not being exacting as to the

particular stage of growth at which it has to be harvested.

Sudan grass was introduced into Texas by A. B. Conner, Vice-Director and Agronomist of the Texas Experiment Station system. The first Sudan grass planted in the United States was at the experiment station at Chillicothe, Texas, about fourteen years ago. This crop has increased rapidly since its introduction and is now a staple, not only in Texas but in many states. A four-year experiment at Chillicothe shows that the highest yield, 5,740 pounds of hay to the acre, was obtained from seeding broadcast at the rate of twenty-five pounds to the acre, but other rates gave such good yields that fifteen or twenty pounds are usually planted.

The introduction of the grain sorghums into west Texas has done much to increase the prosperity, not only of that section but of the entire State. The growth of alfalfa, the grain sorghums, and Sudan grass is certain to become a permanent factor in the development of a large area of west Texas adapted to their cultivation and utilization, both as crops for marketing and the feeding of live-stock in preparation for market.

FRUITS

The principal orchard fruits grown in Texas include apples, peaches, pears, and plums. The last census reports 6,053,442 bushels of orchard fruit produced from 5,878,822 trees in 1919. There were 2,329,306 trees not of bearing age also reported. The

acreage for 1919 was estimated at 167,216, and the value of the total crop at $14,952,135. The State stood eleventh in the value of its horticultural products.

The most important apple-producing counties of the State are Jeff Davis, Runnels, Pecos, Erath, Eastland, Callahan, Montague, Cook, and Wise. The fact that these counties are more or less widely separated is due to the influence of altitude, as well as to temperature and rainfall, on successful apple production. Apples will not fruit successfully near the Gulf Coast. This is due principally to the long, hot, and often dry, summer months.

Texas produced 486,828 bushels of apples from 468,027 bearing trees in 1919. The markets reports of the United States Department of Agriculture for December 23, 1922, estimated the yield of apples at 274,000 bushels for 1921, and 264,000 bushels for 1922. The two sources of information—the fourteenth census and the reports of the Department of Agriculture—show considerable discrepancies, but the figures compiled by the United States Department of Agriculture are probably more nearly correct than those of the census in this particular instance. The most important apples grown in Texas are the Ben Davis, Schockley, Texas Red, Arkansas Black, and other early varieties. The apple industry in Texas has developed in recent years until solid carloads are shipped from the most important market centers. While it is not probable that apple production will ever become a great industry in

Texas, there is reason to believe that apples will be grown more extensively than at the present time. There are small and restricted areas, especially in the plateau regions of west Texas, where apples may be grown profitably.

Peach production in Texas has had an interesting history. The industry began to develop in east Texas in the counties of Smith, Cherokee, and Rusk about 1890, and it spread north and east until the area now includes most of east and northeast Texas. Peach-growing experienced a boon in its early history. A few continuously favorable years resulted in the production of some wonderfully fine fruit that sold for fancy prices. The appearance of the boll-weevil about the same time caused many east Texas farmers to abandon cotton and turn to fruit-growing. Not only were many small peach orchards set out, but individuals and stock companies planted extensive orchards.

Little was known about peach culture by most of those who engaged in this new enterprise. Stock that was bought for transplanting was of poor quality, or diseased. The orchards, on the whole, were poorly cultivated. The trees were often not pruned or sprayed. As a result, many orchards never produced a single crop of fruit; others bore some fruit regardless of neglect, but the fruit that was produced was not sold to advantage. The growers were not organized and they were inexperienced in marketing fruit. Therefore, they were not able to sell their product at an advantage. To add to the difficulties, there

were several "bad years"—that is, mild winters, followed by almost total crop failures. This situation discouraged the peach-growers and greatly retarded the development of the industry for several years. However, in recent years the peach industry in east Texas has experienced a great revival. Small orchards are being planted from carefully selected stock. The yields and quality of the peaches give them high market value. The leading variety is the Elberta. Cooperative marketing organizations have been formed to sell the crop. The general outlook for the industry is promising at the present time.

The peach is by far the most important orchard fruit grown in Texas. The 1920 census reports 4,620,679 bushels of peaches on 4,461,717 trees in 1919, and there were 1,640,848 trees not of bearing age at that time. The total acreage planted in peaches was reported at 55,970. While most of the commercial orchards are in east Texas and the annual crop is somewhat uncertain, home orchards are found in many parts of the State and peaches of good quality are produced over wide areas.

Pears are not grown extensively or very successfully in Texas. Several efforts have been made to develop pear-growing areas without great success. A few years ago a number of orchards were planted in a few Gulf Coast counties and, for a time, the industry promised to be of commercial importance, but most of these orchards have now been abandoned. The principal difficulty in growing pears is due to the blight. The codlin-moth is also a serious menace.

The damages from this pest can be prevented successfully, however, by spraying the trees thoroughly.

The principal pear-growing sections of Texas are in El Paso and Jeff Davis counties, where the altitude is over 2,500 feet. The blight does little damage in these counties. The Bartlett is the leading variety. Pears are also grown with some success in the northeast and in the central part of Texas. The only variety that succeeds in these sections is the Keiffer, which is blight resistant. Small pear orchards are found here and there in central and northeast Texas, and occasionally a large commercial orchard is to be seen, but most of the pears raised are for home consumption or are sold in small quantities for preserving in the local markets. The total production reported by the United States Department of Agriculture for 1921 was 406,000 bushels, and for 1922, 390,000 bushels. El Paso is the largest pear-producing county in the State.

Plums are grown over a wider area in Texas than any other tree-fruit. This fruit is not planted on as large a scale in any one section as either peaches or apples, but it probably ranks first in the number of small plantings. The commercial growing of plums centers around Wood County in east Texas. Two main groups of plums are represented—the American and the Japanese, together with their hybrids. Plums produce prolific crops with reasonable regularity, which justifies their cultivation for profit.

The first citrus-fruit grown in Texas was the orange. This fruit was first planted on a commercial

scale in the upper coastal region of Jefferson, Harris, Galveston, and Brazoria counties. Extensive plantings were made principally to the Satsuma varieties worked on Trifoliata stock. While this is a very hardy stock, most of these groves have been destroyed by low temperatures which occur every few years in that section of the State.

The latest and most promising citrus-fruit region of Texas is being developed in the lower Rio Grande Valley in Hidalgo and Cameron counties. Oranges of the Florida type and grapefruit are grown very successfully. The lower Rio Grande Valley today has more than a million citrus fruit-trees on approximately 10,000 acres of irrigated land. This industry is gaining steadily in importance every year. More than 225,000 trees, according to the estimates of county agents and the Rio Grande Valley Citrus Fruit Exchange, are being planted annually. It is estimated that fifty carloads of citrus-fruit, exclusive of large express shipments, were exported from this section in 1921. According to present growth of the industry, some 2,000 cars will be shipped from Cameron and Hidalgo counties in 1923. At an average price of $4.00 a box and 350 boxes to a car, the crop of 1923 should sell for not less than $2,800,000. If the citrus-fruit industry of this section continues to grow at its present rate, the lower Rio Grande Valley will lead in perishable crops in a few years.

Sixty per cent of all the citrus trees in the Rio Grande Valley are grapefruit, 35 per cent oranges and 5 per cent lemons, tangerines, and kumquats.

About 45 per cent of all grapefruit trees are Marsh seedless, an excellent type and a good shipper. Forty per cent are Duncan, which is becoming very popular. The balance are the Florida common and the Foster pink tinge, a sub-acid variety which commands a fancy price on the market.

The Valencia orange is a standard variety in the lower Rio Grande Valley. It is yellow-meated and a good shipper. It is one of the earliest and has the advantage of coming on the market before the California orange crop. A very early Rio Grande orange is the Parson Brown which bears about the last of November and early in December. The Seville and the Temple are attractive varieties that have been introduced into the Rio Grande Valley from Florida.

The tangerine is a Satsuma orange and a prolific bearer. Some trees in the lower Rio Grande Valley bear eight bushels to a tree at the age of ten years. The tangerines come into bearing in December and January. The Dancy is the leading variety. The King orange, one of the mandarin group, has a high flavor, is a fair bearer and is coming into considerable popularity in this section.

The kumquats are a peculiar looking citrus-fruit, elongated in shape and yellow, or orange, in color, with a subacid flavor and are eaten in salads. Both pulp and skin are consumed. They find a ready market in the fancy trade of the North and East, and their production is increasing in the Valley.

One of the freaks of the citrus-fruit industry in this section is the Ponderosa lemon, a huge variety

often attaining almost the size of a football. Its huge size has prevented its popularity for domestic use, but its flavor is finding favor with confectioners and bakers. A process is being developed for extracting the lemon juice from this fruit and bottling it for commercial use, thus saving the freight on the pulp and skins. The standard varieties of lemons in the Valley are the Kennedy and the Eureka. They are good bearers and reach full bearing in about ten or twelve years. These varieties frequently produce fruit from August to the following June when well watered.

Figs are very successfully grown in the upper coastal region, the principal counties being Jefferson, Harris, Galveston, and Brazoria. The leading variety is the Magnolia. Figs have a commercial value for fresh fruit and preserving. The commercial demand for figs justifies extending the area and plantings in Texas.

Strawberries, blackberries, and grapes are of considerable importance in Texas. Strawberries are grown only in restricted areas in the coastal region. They cannot be raised profitably above the frost line, or where the climate is very hot and dry. The oldest strawberry section in the State is at Pasadena, Hitchcock, and surrounding territory in Harris and Galveston counties. Strawberries were grown as a commercial industry in the vicinity of Alvin for several years, but the production has declined recently. They can be raised successfully in most parts of east Texas. The most recent development has been in

Smith, Camp, and other counties of that immediate section. The Texas crop of strawberries for 1921 was estimated at 100 carloads.

Both blackberries and dewberries are indigenous to Texas. They are found in profusion in the spring over most of east, north, central, and southwest Texas. The cultivated varieties do exceptionally well and more of them should be planted. The Nessberry, a cross between the dewberry and the raspberry, which was produced by H. Ness, Research Horticulturist in the Texas Experiment Station, is of unusual size and flavor and gives promise of being a very prolific and popular variety.

The most important berry sections are in Smith and Wood counties in east Texas. At Lindale, in Smith County, there is located a large and successful berry cannery. Berry production in Texas has commercial importance and should be encouraged and developed.

Many wild species of grapes flourish in Texas, but only a few varieties are planted. In the extreme western part of the State, near Alpine and El Paso, European varieties can be grown successfully, provided they are worked on resistant stock. These varieties cannot be raised in other parts of the State on account of the black-rot, mildew, and root-louse. The Munson variety, some of which contain blood of the European species mixed with the native grape, is grown successfully in north, west and east Texas. The last census reports 2,256,328 pounds of grapes harvested in the State.

VEGETABLES

A great variety of vegetables can be grown in many sections of Texas, where the soil and climate are peculiarly adapted to their development. These sections, as a rule, are remote from the centers of consumption, making it necessary to transport vegetables long distances before they are placed on the market.

The most important vegetable grown in the State is the sweet potato. It is produced over a large area but the most important commercial section is in east and central Texas. Two factors offer considerable promise to the industry. The good quality of many of the sweet potatoes grown in Texas has greatly extended the market demand for them, and the possibility of preserving this product in storage-houses has enabled the growers to extend the period of marketing over several months. In recent years a large number of commercial storage-houses have been built in the principal sweet potato-growing sections of the State, which has resulted in increased acreage and better varieties of potatoes. In 1919, 89,000 acres were planted to sweet potatoes, which yielded 9,345,000 bushels. This is almost exactly twice the yield of Irish potatoes for that year. The acreage has steadily increased in each succeeding year, although the production has not been quite uniform. The State produced 9,975,000 bushels on 95,000 acres in 1920; 8,200,000 bushels on 100,000 acres in 1921; and 8,715,000 bushels on 105,000 acres in 1922. The average yield for 1920, 1921, 1922 was 90 bushels

to the acre. The average value of the crop of sweet potatoes for these three years was approximately nine million dollars.

The Irish potato is grown for home use in most parts of Texas; for commercial purposes, it is more restricted. The most important commercial sections for growing Irish potatoes are near Eagle Lake and Wharton, with a steadily increasing area in the lower Rio Grande Valley. The Triumph and Irish Cobler are the two leading varieties. A large percentage of the seed potatoes come from Maine, Wisconsin, and Minnesota. Kansas and Nebraska have been producing increasing quantities of seed potatoes that are used in this State. The United States Department of Agriculture reports 1,872,000 bushels of Irish potatoes produced on 36,000 acres in 1920; 2,072,000 bushels on 37,000 acres in 1921; and 2,318,000 bushels on 39,000 acres in 1922. The average yield to the acre for these three years was 56 bushels. The average value a year of the crop for the three years was approximately four million dollars.

The cabbage has been grown for many years on a commercial scale in Texas. The most important producing areas are in the Corpus Christi and the lower Rio Grande sections. The commercial crop is harvested during the late winter and early spring months and a large part of it shipped to northern markets. While the crop yields have usually been very large in the Rio Grande Valley, the producers have received very little profit in the past few years on account of high freight rates. In 1920, 16,400 acres

were planted to cabbage, which gave a yield of 6,298 cars.

The growing of Bermuda onions in Texas has developed into an important industry. It centers around Laredo and a few counties to the north and in the lower Rio Grande Valley. The onions are practically all grown under irrigation, the flooding system being used. The land is highly fertilized and it is not uncommon to produce from 20,000 to 30,000 pounds to the acre. The White Bermuda and Crystal Wax are the leading varieties. The seed are obtained from California and the Teneriffe Island. In 1919 there were 12,402 acres planted to onions. These gave a yield of 5,550 carloads.

The production of tomatoes has developed into an industry of importance in east Texas, with Jacksonville as the center. The season for marketing is very short, due to the perishable nature of this product, but under improved marketing conditions the industry promises to be profitable. In 1919 there were 8,850 acres of tomatoes planted that produced a yield of 33,630 tons.

Watermelons and cantaloupes are grown extensively in many parts of Texas, soil and climatic conditions being favorable to their production. Watermelons grow to large sizes and in good seasons possess excellent flavor. The crop comes on in the early summer in southwest and south Texas and, while the season is short, due to the variety of climate, the crop is being marketed in some sections of the State over a period of nearly four months. Hempstead,

in Waller County, is one of the most important watermelon shipping points. Hundreds of cars of fine melons are shipped from this point to northern markets during the month of June.

NUT-CULTURE

The only nut of commercial importance in Texas is the pecan. This is indigenous only to part of the southern United States and a small section of Mexico. There are estimated to be between fifty and seventy-five million native pecan trees in Texas. Thousands of native trees that were here when the Spaniards founded the missions are still producing heavy crops of nuts. Texas contains more native seedling pecan trees than all other states combined. Most of these trees are along the Trinity, Brazos, Colorado, San Antonio and Nueces rivers, and their tributaries.

Texas produces at least three-fourths of all pecans grown, which shows the State to be well adapted to their production. According to the United States census for 1920, the number of Texas farms reporting pecan trees not of bearing age was 9,590, as against 6,174 in 1920. The number of trees was estimated as 449,464, as against 621,550 in 1910. The number of farms having trees of bearing age in 1920 was 19,204, as against 10,519 in 1910. The number of trees reported for the same years was 1,045,694 for 1920, and 1,087,619 for 1910. The production for the year 1919 was 16,755,421 pounds,

valued at $3,686,191, as against 5,832,367, valued at $556,203 for 1909.

There are as many varieties, so to speak, of these native nuts as there are different trees, but most of them are small, having too thick shells and sometimes containing bitter partitions between the kernels. While the meat is delicious in flavor, it is small and difficult to extract and does not run a high proportion to the total weight of the nut.

Texas produced in 1919 between 800 and 1,000 carloads of native pecans. In that year there were shipped from San Saba three million pounds or 100 carloads of native pecans. The same year all other states combined produced less than thirty carloads of both native and improved varieties of pecans. The pecan crop of Texas for 1921 was valued at over two million dollars. Nowhere else in the world has nature, unaided by man, produced such a valuable crop of either nuts or fruits.

Less than 20 per cent of the native trees of Texas produce pecans of commercial value. It is, therefore, highly desirable to top-work most of the non-productive seedling pecan trees to improved varieties which will bear nuts of a very high quality in two to four years.

Two great classes of the improved pecans are grown in Texas—the west Texas and the coast varieties. The west Texas varieties have developed from seedling trees and as a result of cross-breeding are better adapted to north, central and west Texas. They should not be planted within 150 miles of the

coast, due to the fact that they are attacked by the pecan-scab in low altitudes where there is abundant rainfall. Coast varieties should be planted in the eastern and southern sections of the State at places within 150 miles of the coast. The most important west Texas varieties are the Texas Prolific, Onliwon, San Saba Improved, Western Schley, Burkett, Halbert, Oliver, and Hollis. The most important coast varieties are the Delmas, Success, Schley, Stuart, Moneymaker, Moore, and Pabst.

The Horticultural Department of the Agricultural and Mechanical College of Texas now has fruited about twenty-five leading west Texas and Coast varieties. The Department has many trees on its demonstration plots at the College that have been top-worked by the different methods now used in working over seedling trees to improved varieties. Increasing interest in pecan culture in the State has resulted in the College offering a full course in the study of the pecan.

Commercial orchards of pecans are being developed in many parts of the State. The only extensive pecan orchard in Texas that has reached the age of bearing is at Winona, near Tyler, in Smith County, which is owned by northern capitalists. It was originally a peach orchard, but the crops were so uncertain that pecan trees were inter-planted in order to relieve the investment of the element of possible losses. This orchard was planted about ten years ago and today is valued at a million dollars, or a thousand dollars an acre, and is paying the stock-holders handsome

profits on their investment. This is but one example of what is likely to be duplicated at many places in the State within the next few years in the commercial production of improved varieties of pecans.

In this discussion emphasis has been laid on the horticultural products of commercial value. The home garden and orchard in Texas deserve consideration in the appraisal of the productive resources. There is scarcely a fruit or vegetable of actual food value that cannot be grown as a home garden product in most sections of the State. The great variety of fruits and vegetables grown with little effort and small expense contributes greatly to the prosperity and standards of living of the Texas farmer. While many of these products do not enter into the commercial production of the State, they do reduce the cost of living and, thereby, contribute to the health and prosperity of the farm population.

CHAPTER VII

ANIMAL INDUSTRIES OF TEXAS

Live-stock production in Texas is associated with hardships, romance, and adventure. The picturesque cowboy is passing and the open range in Texas is but a memory, but animal production today is the product of earlier ranch conditions and there remain in the western part of the State many survivals in the ranching practices of the present time.

It is generally believed that the first cattle introduced into Texas were from Mexico, although the foundation stock for most of the herds located in the eastern part, in all probability, came from Louisiana and other neighboring states. This original stock was of the ordinary scrub type. Captain Abner Kuykendall, who settled on New Year's Creek within the present limits of Austin County, brought with him from Arkansas a few head of cattle. This stock was similar to that previously introduced into the State from Louisiana.

The first improved breeds of cattle were not imported into the United States until 1817, and it was many years before much attention was given to improving these breeds in Texas. Texas fever greatly

retarded the introduction of high grades and full-blood cattle. The discovery by Dr. Mark Francis, Professor of Veterinary Medicine in the Agricultural and Mechanical College of Texas, that this disease was due to the tick and the work of inoculation that has been done by the Texas Experiment Station of the College have been of inestimable service to the live-stock producers. Tick eradication work conducted jointly by federal and state agencies has improved live-stock conditions. As tick-infested counties have been cleaned up, better qualities of live-stock have promptly been introduced. It is only a matter of a few years now until the Texas fever-tick will be completely eradicated. This will certainly result in increasing the number and the quality of cattle in the State.

Many other conditions have encouraged the live-stock industry in recent years. The long drives over the famous cattle trails of the pre-Civil War period involved hardships and uncertain market conditions. Occasionally the trail drivers came into personal conflict with red-skinned cattle thieves and envious live-stock producers on the way, resulting often in physical violence and the confiscation of cattle. Finally railroads were built and the cattle trails were gradually abandoned as they were extended through the cattle country. The extension of the Texas and Pacific railroad from Fort Worth to El Paso through the center of the ranch sections in the early eighties was of great value to the live-stock industry.

Barbed wire fences which were introduced in the early seventies ushered in the period of wire cutting and a conflict between the ranchmen and the so-called settlers. The passing from the free-range to the leased-range was a result of the introduction of barbed wire. The period of the leased range gradually gave way to private ranch ownership, which dates from about 1904.[1] The barbed wire fence enclosure of ranches also brought about the building of rock tanks and the digging of artesian wells. These sources of water for live-stock have largely done away with the necessity of the old-time watering places. The discovery by the ranchmen that cattle would do as well on well-water as that from a running stream had a marked influence on the industry. Live-stock production has also been encouraged greatly in recent years by the growth of forage crops in the immediate ranch sections of the State. The grain sorghums and Sudan-grass have proved to be well adapted to a large area of west Texas. Dependence on grass is no longer an absolute necessity. The Agricultural Experiment Station of the Agricultural and Mechanical College has proved by actual tests that grain sorghums have 93 per cent of the feeding value of corn. Silos, small grains, and grain sorghums are proving of inestimable value in the development of the agricultural and live-stock resources of the western part of the State.

[1] See *An Economic Study of a Typical Ranching Area*, by B. Youngblood, Bull. No. 297 of the Texas Exp. Sta. (July, 1922), p. 75.

BEEF CATTLE

Early statistics of the cattle industry made no distinction between milch cows and other cattle. In 1833 the Spanish missions estimated their holdings at 424,000 cattle in the State. The census of 1850 was the second cattle census, but the first separating milch cows from other cattle. The increase in the number of beef cattle under the improved conditions that have been outlined is indicated in the following tabulation:

NUMBER OF BEEF CATTLE

Year	*Number in Texas*	*Total for United States*
1860	2,934,000	17,034,000
1880	4,289,000	27,232,000
1900	6,419,000	35,268,000
1920	5,323,000	46,977,000

These figures clearly indicate the relative importance of beef cattle produced in Texas to the total in the United States. The ratio of cattle raised in Texas to the total in the nation gradually increased until very recently. The long drought of 1916, 1917 and 1918, followed by financial depression, resulted in a great decrease in the number of beef cattle, but these conditions were temporary and the industry has gradually improved with better range conditions and the gradual recovery to normal of markets and financial conditions.

In 1921 the total number of beef cattle was reported

at 5,310,000 and in 1922, at 5,363,000—the increase in the latter year being due to conditions to which reference has been made. While Iowa leads all the United States in the number and value of live-stock on farms, Texas is first in the number of animal units. The total value of beef cattle in Texas was estimated by the United States Department of Agriculture at $165,672,000 in 1921, and at $106,724,000 in 1922.

The three leading breeds of beef cattle in Texas in the order of their importance are the Herefords, the Shorthorns and the Aberdeen-Angus. Grades and pure-breds of these breeds have almost completely displaced the famous Texas Longhorn. The improvement in the breeds of cattle in Texas has developed rapidly since 1910, due to the gradual elimination of the fever-tick, to which reference has been made, and enforced diversified farming resulting from the ravages of the boll-weevil.

The total number of farms reporting beef cattle in the census of 1920 was 112,628, or 25.8 per cent of all the farms of the State. Texas stands third in the Union in the number of farms raising beef cattle, being exceeded only by Iowa and Missouri.

The importance of the pure-bred industry in Texas is shown by the fact that, according to the census of 1920, over 5 per cent of all farms having beef cattle raised pure-breds. Slightly over 6,000 farms reported pure-bred beef cattle. More than 20 per cent of the farms with beef bulls had pure-bred animals, thus indicating good grades of cattle

on many farms and ranches. Texas stands first in the number of registered Herefords, twelfth in the number of registered Aberdeen-Angus and fourteenth in registered Shorthorns, including Polled Durhams. The total number of pure-bred cattle in the State, as reported in the fourteenth census, was 89,743, which is approximately 2 per cent of all the beef cattle.

Brahma cattle is a breed of increasing interest and importance in Texas. This breed is becoming increasingly popular along the Gulf Coast country and in certain sections in the western part of the State. These cattle were originally imported from India. They are prolific, large of size and rapid of growth, stand heat well, suffer little from parasites, and are almost immune from tick-fever. These qualities have made them popular in the tick-infested sections. Brahma bulls have proved valuable for crossing with the native beef cattle. Grades from this cross produce good beef types. Immunity from Texas fever extends normally to cattle having as little as one-eighth Brahma blood. The Brahma cattle probably have a permanent place in the cattle industry of the State.

Beef cattle production in early days was almost completely confined to the large ranches of west Texas, but in recent years the industry has spread over almost the entire State. A few beef cattle are being produced on many farms throughout central and east Texas, and in the aggregate these sections are producing, and will produce, beef cattle in in-

creasing numbers. When the fever-tick is eradicated, as it surely will be in a few years, the entire State will be available for beef cattle production and the importance of the industry will be greatly increased.

DAIRY PRODUCTION

The most highly developed and specialized of all animal industries is dairying. The growth of Texas cities and the concentration of population, together with cheap and more abundant forage crops and their conservation in silos, have had a decided influence on the dairy industry of Texas.

As one would expect, the dairy industry is more extensive and important in the eastern part of the State. While dairying is rapidly developing in the west, the large ranches and relatively small population with few large cities prevent it from becoming an important industry. Ranching is largely devoted to beef cattle production and only a sufficient number of dairy cows are maintained for local purposes and as nursing cows for young calves.

Texas stood eighth in the number of dairy cattle in 1920, the number reported for that year being 1,030,556. In 1921 there was an increase of approximately 12,000 dairy cattle over that of 1920, with about 30,000 increase in 1922 over that of the preceding year. The number of pure-bred dairy cows was reported at 23,364 in 1920. Texas is exceeded only by eight states in the number of pure-bred dairy cows. While the total number of dairy cows in the United States about equals that of beef cattle, in

Texas the number of dairy cattle is only about 20 per cent of the total number of beef cattle.

Dairy cows were reported on 266,843 farms, or 61.2 per cent of the total number in the State, on January 1, 1920. The breeds of dairy cattle in the order of their importance are the Jersey, Holstein, and Guernsey. The percentage of different breeds to the total number of cattle is as follows: Jerseys, 9.4, Holsteins, 3.4, Guernseys, .2. There are also a few herds of Dutch Belted and Ayrshires but they are relatively unimportant. There are very few brown Swiss cattle in the State, but these cattle would probably do very well in certain sections where the climate is cool throughout the year. The Jersey is the popular dairy cow on the small farms of central and east Texas. There are a number of large Jersey herds in the State. The Lasseter herd of Jerseys at Falfurrias is notable for its size and quality. The Holstein is also a popular dairy cow and the number is rapidly increasing. There are many large commercial herds of Holsteins, most of which are near the larger cities of Texas. In most cases a few Jerseys are found with these herds. The milk of the Jersey is mixed with that of the Holstein for the purpose of increasing the butter-fat content of the product.

The principal dairy products marketed in Texas are milk, cream, butter-fat, and butter. The production of cheese is an unimportant industry. The total value of dairy products sold in 1920, as reported in the census figures for that year, was approximately

$33,000,000. The value of butter comprises over $22,000,000 of this total, milk over $8,000,000, and cream slightly more than $2,000,000. The value of dairy products sold has increased 110.5 per cent in the period from 1909 to 1919, and the increase in the number and quality of cattle will certainly result in continued increase in the value of dairy products. Creameries are rapidly being built in a number of places and, under expert supervision, are proving successful. Wherever there is a successful creamery, the number of dairy cows in the surrounding territory is rapidly increasing. This situation insures a prosperous dairy industry for the State in the future.

SHEEP AND GOATS

Sheep and goat production developed into an industry at an early day in Texas. Sheep and goats were brought into this State by missionaries in the latter part of the seventeenth century. In the early nineteenth century there were a number of large flocks of sheep in the range country between the Rio Grande and the Concho rivers. The mountainous and broken country in the western part of the State is particularly well adapted to sheep and goat production. The number of flocks and the importance of the industry have increased greatly in recent years.

The sheep industry reached its maximum in 1883 when the number in Texas was reported at 7,952,273.[1]

[1] Fourteenth Annual Report of the Bureau of Animal Industry of the U. S. Dept. Agr. for 1891, p. 297.

This number is more than twice as large as that credited to Idaho, which in 1920 stood first in the sheep produced. Texas maintained leadership as a sheep producing state of the Union until 1890. During the ten years following this date there came a sharp decline in the number and value of the sheep owned by farmers and ranchmen. The principal causes of this decline were the cutting up of many ranches into farms and the animosity of the cattlemen for the sheepmen, resulting from the practice of grazing flocks of sheep over the cattle ranges. A new factor which has entered into sheep production in Texas has been the increasing price of grazing lands. During the past generation these lands have increased in price from thirty and forty cents an acre to five to fifteen dollars.

The increase in land values has compelled the ranchman to study the carrying capacity of his range. In order to earn a reasonable return on his capital investment, the ranchman has been compelled to graze his range to the limit, and still he has been confronted with the necessity of not over-grazing, thereby permanently injuring his grass stock.[1] This situation has compelled stockmen to practice diversified grazing. It has been found that by judicious stocking in cattle and sheep, both do better than when

[1] The carrying capacity of the range has become an important matter. For a good definition of the phrase "carrying capacity" and an able discussion of this topic see Bull. 297, Chapter 8, of the Texas Agr. Exp. Sta., entitled *An Economic Study of a Typical Ranching Area*, by Dr. B. Youngblood.

only one class of animal is allotted to the range. While this has been known to a few stockmen for a long time, its general recognition and practice have been rather recent.

Diversified grazing has increased the number of sheep and goats on Texas ranches until the State again leads in the number and value of its sheep and goats. The total number of sheep was estimated by the United States Department of Agriculture at 3,047,000 in 1921, and 3,077,000 in 1922. The total value of all the sheep was estimated at $18,587,000 in 1921.

The significance of the sheep industry is more fully appreciated when the extent and value of the wool production is understood. Texas produced 18,200,000 pounds of wool, valued at $2,600,000 in 1920, and about the same amount in 1921.

Great progress has been made in the goat industry in Texas in recent years. This development has centered around the Angora goat. The first Angora goats were imported into this country from Turkey in 1849 by James B. Davis, of Columbia, South Carolina. Since that time several importations have been made to the United States from Turkey and South Africa. In recent years importations of Angora goats have been forbidden by foreign breeders, but the number has continuously increased as a result of good range conditions and careful breeding.

One-half of all the goats of the United States are in Texas, the number being estimated at 1,753,112. The goat industry is concentrated on the Edwards

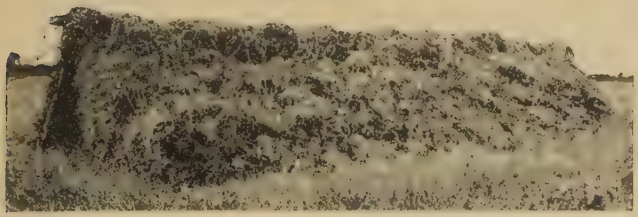

PLATE VII. Above, harvesting Sudan grass on a west Texas farm. Below, a rick of peanut hay in east Texas. The peanut has become a field crop of increasing importance in many parts of Texas in recent years.

Plateau in southwest Texas. Diversified grazing is practiced in this area and cattle are pastured on grass, goats are browsed on scrub oaks and other brush, while sheep eat the weeds as well as the grass and brush. Most of the goats in Texas are Angoras.

The principal economic value of the goat has been the production of mohair, but recently an effort has been made to popularize goat meat. The mohair produced in the State in 1920 was estimated at 5,084,000 pounds, which sold for $2,673,275. The Sheep and Goat Raisers' Association of Texas has recently given the name Shevon to goat meat with the idea of popularizing it and bringing it into competition with mutton and veal.

HORSES AND MULES

One-third of the horses and two-thirds of the mules are raised in the corn-belt of the United States. Comparatively few horses and mules are produced in the cotton-belt. The reason is that it is more economical to ship mature horses into regions where surplus grain is less abundant than it is to ship the grain on which to feed mules and horses. However, Texas raises sufficient grain, especially corn and forage crops, to enable the State to take relatively high rank in the production of horses and mules. There were 981,000 horses, valued at $75,537,000, in Texas in 1921, and 991,000, valued at $57,487,000 in 1922. The number of mules was less than the horses, but the total value exceeds that of the horses by approxi-

mately $18,000,000. Taking the nation as a whole, there has been a decline in the number of horses in each successive year for the past three years (1920, 1921 and 1922) and an increase in the number of mules. Texas, on the other hand, has maintained about a uniform number of horses, but the mules have increased during the past year.

Horses and mules are generally produced as a secondary or subordinate industry on Texas farms. They are raised in small numbers over most of the agricultural sections. The census of 1920 reports horses on 312,896, or 71.8 per cent of the farms, and mules on 281,761, or 64.6 per cent of the farms of the State. There are a few breeders in Texas who are producing good horses for special purposes, but the number is comparatively small.

While motor-driven machinery is supplanting the horse in many industries in Texas, as elsewhere, the mule is still used in large numbers on the cotton plantations and on the smaller farms in central and east Texas. There is also a normal demand for draft horses, as well as saddle horses. It would appear, therefore, that the raising of a few mules and horses will continue to be a remunerative industry.

HOGS

Texas ranks seventh in the number and value of swine produced. On January 1, 1922, the estimated number of hogs in the State was 2,426,000. This increased to 2,475,000 in 1922. The value of the

swine produced in Texas was estimated at $28,627,000 in 1921.

Swine were reported on 306,000, or 70.2 per cent of the farms of Texas in 1920. They are widely produced on a large percentage of farms throughout east, south and central Texas. Thirty-one counties produced more than 20,000 hogs each in 1919. The counties of largest production are as follows: Anderson, 33,111; Henderson, 31,807; Shelby, 30,350; Leon, 30,300; Milam, 29,774; Polk, 29,436; Houston, 29,258; Liberty, 29,143; Fayette, 27,497; Rusk, 27,188; Robertson, 25,957; Nacogdoches, 25,082; Red River, 25,073; Lavaca, 24,982; and Dallas, 24,621.

There has been a great improvement in the quality of Texas swine in recent years. The east Texas razor-back hog is almost as rare as the once famous Texas Longhorn steer. According to the last federal census, Texas stood ninth in the number of registered swine, the total being estimated at 70,853 head. Duroc-Jersey, Poland-China, Hampshire, and Tamworth constitute the principal breeds. Chester-White and Essex are also produced, but the number is negligible. There are a number of breeders of one or the other of the more popular breeds. It is significant that, in addition to the large breeders, there are many small breeders producing a few pedigreed hogs of high quality that are being disposed of at excellent prices. The swine specialist of the Extension Service of the Agricultural and Mechanical College reports that "Texas breeders, most of whom were

small breeders, received at public auction in six weeks, in January and February of 1921, over $90,000 for pedigreed hogs. These hogs were sold at an average price of $150 each."

Hog cholera has been a great handicap to the swine raisers of the State and the losses sustained have been very great. The School of Veterinary Medicine of the Agricultural and Mechanical College of Texas has produced large quantities of hog cholera serum which has been supplied to the swine raisers practically at cost. The swine specialist of the College, assisted by farm demonstration agents, has assisted farmers in administering the serum and otherwise contributed to cholera control measures. As a result, hog cholera has greatly declined and the industry has thereby been encouraged.

Swine production in Texas seems certain to increase in importance in the next few years. The numerous small streams with ample shade that are found in many parts of the State, the increasing varieties and adaptabilities of grass crops suitable for swine, and the attention that is given to the raising of pedigreed stock will certainly result in the continued production of a large number of hogs of good quality and value.

POULTRY

Poultry raising is carried on rather extensively in all parts of Texas. The census of 1920 reported poultry on 384,878, or 88 per cent of all farms in the

State. This is greater than that for any other form of live-stock. Most of the development of this industry is in connection with general farming. Most farms have a flock of chickens to supply home needs, which during a season of good production nets a surplus that is sold to breeders or country merchants. During the past few years considerable attention has been given to commercial poultry farming and there is an increasing number of such farms exclusively devoted to poultry raising.

The number of birds to a farm and of eggs to a hen is small, but a very decided and encouraging increase has taken place during the past few years. The census of 1920 reports approximately nineteen million chickens, turkeys, ducks, geese, and pigeons on Texas farms. The value of the poultry and eggs for 1920 was estimated at $16,675,000.

A large amount of poultry and eggs is exported annually to the eastern markets during the period from December to June. The great bulk of turkeys is usually shipped dressed during the months from October to January. One large railroad reported 340 cars of eggs, 506 cars of live poultry and 104 cars of dressed poultry shipped from the State to Boston and New York in one year. Another railroad that traverses an important poultry section reports 600 cars of poultry in one year.

The greatest development in poultry has taken place in the northeast-central part of the State, in the district east of the section represented by a line drawn from Montague to Bexar County.

The most popular breeds of chickens are the Single-Comb White Leghorn, the Barred Plymouth Rock, and the Single-Comb Rhode Island Reds. Many breeders have developed excellent egg-producing strains of these breeds. Through local poultry associations, local poultry shows, marketing organizations and the like, farmers and poultrymen have given much attention to their flocks, with the result that in many localities very great improvement has been obtained. In fact, in some places, notably Dayton, a great demand has developed for their eggs and the industry has contributed very greatly to the prosperity of the community.

Production has been increased greatly by two large poultry shows that are held annually. The show in the fall at the Texas State Fair, at Dallas, is one of the largest of its kind in America. Each January the Premier Show, which is also held in Dallas, gives the breeders of the Southwest an opportunity to display their fine birds in competition with the breeds of the adjoining states. Usually there is also held annually a state egg show which interests the producer and consumer in the production of fine quality eggs. The Texas National Egg Laying contest, now in its fourth year with 500 birds entered, contains representative specimens of high-layers from many of the foremost flocks of the country.

Texas is the greatest turkey-producing state in the Union, and each year large numbers are shipped to consumers of the North and East. The localities around Fayette and Dewitt counties are widely fa-

mous for their turkey production. A unique show is held at Cuero annually in the month of November in which there are often from 2,000 to 5,000 or more turkeys on display. This show is called the "Turkey Trot" and is made a gala affair in which officials and high dignitaries of the State, and often of the nation, take part. (Plate XI.) The President of the United States always receives one of his Christmas turkeys from a choice selection from one of the flocks displayed on this occasion.

The breeds of turkeys most commonly raised are the Mammoth Bronze, the Bourbon Red, and the White Holland, the first variety, however, being by far the most popular. This breed of turkeys is well adapted to Texas and is very hardy and rugged and does especially well on the semi-arid ranges of the West and Southwest.

There are many turkey packing-plants over the State, most of them handling many birds in a season. In fact, one of these plants in north Texas in one year shipped approximately 1,500,000 pounds of dressed turkeys and 2,000,000 pounds of other poultry. In addition, they handled approximately 40,000 cases of eggs. Another house in south Texas ships each December about 300,000 pounds of turkeys.

Ducks and geese are not raised very extensively, as the demand for products of this kind is rather limited.

In the production of chickens, the tendency of most farmers is to enlarge their flocks to a size that will

warrant more care and attention and result in the production of eggs and meat in amounts great enough to command special attention in the markets. Most of the farms are eliminating the unimproved scrubs and replacing them with pure-bred birds that in many instances have received special attention in breeding along lines of increased egg production. Some communities have progressed a step farther and have adopted one breed, or even one variety, which will enable them to produce for market purposes a very uniform and superior product.

A few years ago a well built and comfortable poultry-house on a farm was rarely seen, and the practice of feeding balanced rations to chickens was unknown. In fact, even in marketing eggs, quality and external appearance were rarely considered. The result was that in most seasons of the year ten cents a dozen was a good price for eggs and three dozen for twenty-five cents was the usual price. Today good poultry-houses are to be seen on many farms. They are usually equipped with feed-hoppers, sanitary watering devices, concrete floors and in not a few instances with electric lights. Special fields are planted to succulent green crops and every precaution is adopted to prevent infestation of vermin or disease contamination.

Many communities have organized egg-selling clubs known as egg circles. These circles give special attention to the maintenance of their flocks and to the production and marketing of eggs, yielding a product of the very highest quality and attractiveness for

which the markets of the State pay a substantial premium. These practices have resulted in making poultry one of the most profitable and interesting sources of income of the farm.

Diseases known as sorehead and roup have been discouraging to poultry producers. However, the veterinarians of the Agricultural and Mechanical College, by the production and distribution of serum, have brought these diseases under control.

Increasing attention to the breeding of poultry has brought encouraging results. Many breeders are producing hens that have records of 200 eggs and better on their own farms or in egg-laying contests. One Barred Rock breeder in the south-eastern part of the State has been a consistent winner in the egg-laying contests every year for the last three years. This breeder had the highest pen over all breeds in the first contest, was second in the second contest and, last year, was the winner over all breeds and varieties by a great margin. This pen averaged for the year 198.8 eggs.

A very striking illustration of the effect of good breeding was noted in the third Texas egg-laying contest. The highest pen for that year was a Single-Comb White Leghorn, with a production of 228 eggs. The lowest hen in the contest was also a Single-Comb White Leghorn. This individual laid only fifteen eggs. These two birds were in the same pen for the entire year and received the same care and attention, ate the same balanced rations, and were subject to the same management. Hens producing

eighty eggs or less a year return very little, if any, profit. In fact, those with yearly productions of less than 100 eggs are hardly worthy of being retained as egg-producers. These facts have become generally known to the poultrymen and egg production has been greatly influenced by the knowledge.

BEEKEEPING

The honey-bee is usually considered one of nature's conservators. In most other agricultural endeavors it is necessary to produce something by husbanding and cultivating the soil; not so with the honey-bee. It gathers and conserves what otherwise would go to waste. Texas farmers have profited by the instinctive habits of the honey bee. The census of 1920 reports hives of bees on 36,283 farms, which is 8 per cent of the total number of farms of the State.

The climate and flora of the State are favorable to honey production. Because of the great size of Texas, the flora varies greatly. The State is naturally divided into five regions with reference to honey production, each of which has somewhat the same climatic conditions and similar flora. The extent of the beekeeping industry is largely determined by the prevalence in the locality of one or more plants which secrete a large surplus of nectar. There is a great variety of nectar-secreting plants in Texas. Those belonging to the family Leguminosæ are the most important and also the most wide-spread. There are vast areas covered with mesquite, haujilla,

cats-claw, and many other plants which are peculiar to the southwestern part of the State where there is little rainfall. Beekeeping is an important industry in some parts where the land otherwise cannot be utilized for agricultural purposes.

The beekeeping regions may be described roughly as the Rio Grande, the arid, the cotton, the east Texas and the Pecos. The arid and the Pecos region are somewhat similar, the chief difference being that in the Pecos alfalfa grows well under irrigation and produces a large amount of nectar.

The lower Rio Grande Valley constitutes a rather distinct region where the climate is mild and a continuous honey flow is possible. This section is especially adapted to the raising of queens and the shipping of pound packages to northern honey producers. Some of the honey plants, such as agarita and mistletoe, bloom in February. The other honey plants of this section are horse mint, cotton, Texas ebony, white brush, mesquite, coma, and Brazilwood.

The arid region of honey production may be roughly defined as that part of the State lying west and southwest of the escarpment which runs east and west between San Antonio and New Braunfels, thence southwest through Cuero and Victoria to the Gulf. The honey plants of this section are somewhat similar to those of the lower Rio Grande Valley. The long continuous season of flowering plants of different kinds makes this a very important honey-producing district.

The cotton region includes the fertile black land

belt of Texas in which is grown nearly one-seventh of the world's supply of cotton. Although beekeeping has not been developed here to the extent that it has in the arid region, there are many commercial beemen. The cotton plant produces the most nectar on a deep black soil and this section, on this account, is the greatest yielder of cotton honey. There are numerous other plants that yield good surplus honey supplies. In the northern part of this region, especially along the Red River, sweet clover is an important honey plant.

East Texas has a variety of soil conditions, and its flora is more varied than that of any other part of the State. The average possibilities are better perhaps in this section than in any other. The variety of plants is much greater and there is still much unoccupied land on which flowering plants grow. Among the many honey plants are basswood, horse mint, rattan, partridge pea, Youpon, Madeira vine, sweet gum, marigold, and blackberries. There are fewer commercial beekeepers in this section than in the cotton and the arid region, but the industry is gradually developing. The honey plants of the Pecos region are similar to those of the arid sections. Alfalfa production around Balmorhea has furnished an additional source of nectar for honey. This is the most important honey plant in the Pecos region.

In addition to the major honey plants of Texas, including horse mint, the cotton plant, mesquite, which is the main source of the famous Uvalde honey, huajilla and cats-claw, there are a great many others

of which mention should be made. These include white brush, alfalfa, sumac, marigold, Youpon, rattan, basswood, prickly pear, broomweed, partridge pea or sensitive plant, bitterweed, and sweet clover. In some localities one or more of these have been the major honey plant.

Next to California, Texas has the largest number of persons devoting their whole time to the production of honey. Practically all the market honey is sold as extracted or chunk honey. Very little comb honey is produced for market, most of it being consumed locally. Most beekeepers, as a rule, use up-to-date equipment for extracting honey for market purposes. Most of this extracted honey is sold in sixty-pound cans and the greater portion is consumed within the State.

In recent years the shipping of bees to the North in combless packages has become an important industry. This not only solves an important problem for the beekeeper, but also returns a good profit. In the spring in some localities bees build up a long time before the major honey flow. As a consequence, they attempt to swarm, and either a part of them may be lost or a great amount of work is necessary to keep them from swarming. By removing part of them from the colony and shipping them North the keeper solves a difficulty in connection with apiary management and makes a profit which otherwise would be lost.

In addition to those who are interested in the production of honey and the shipping of combless pack-

ages, there are a great many who devote all or part of their time to raising queens. The climatic conditions in certain parts of the State are admirably suited to this industry. Queens can be raised and shipped by the time they are needed by northern beekeepers.

The Texas Honey Producers Association has accomplished a great deal for the well-being of the beekeepers of the State. The officers of this Association consist of a board of seven directors who are elected by the stockholders. The board of directors elect a president. This organization is very active in promoting the interests of honey producers, and it has been largely responsible for the commercial development of the industry in Texas.

CHAPTER VIII

TRANSPORTATION AND RURAL COMMUNICATION

Facilities for transportation and systems of intercommunication are vitally related to rural economic and social welfare. No appraisal of rural life is complete without a review of the development of these agencies and a consideration of their adequacy to meet the requirements of the agricultural population.

One of the greatest handicaps to the development of Texas previous to the Civil War was the inadequate transportation facilities. The rivers of the State were not navigable to any great extent, the roads were almost impassable in bad weather, there were few bridges and ferries across the streams and these were widely separated, and there were no railroads. Farm products that the farmers wished to sell often had to be hauled hundreds of miles to markets or shipping points on the Gulf Coast. Cattle and horses had to be driven long distances to market. Merchandise, purchased or exchanged for farm products had to be transported long distances at great cost. Ox wagons were principally used for transportation of farm products and merchandise. A large number of teamsters were engaged in "wagon-

ing" and "freighting," as these primitive vocations were called.[1]

Jefferson, in east Texas, and Galveston, on the Gulf Coast, were the principal market points. Ox teams required from two to three months to make the trip to market and return from most parts of the State. The distance and conditions of transportation often caused the farmer and the stockman to sell their products at a loss, and freight charges on merchandise made all but the bare necessities of life prohibitive. Slow and inadequate transportation was the principal cause of the late development of the rich agricultural lands of central and north Texas.

RAILROAD DEVELOPMENT

This impossible situation very early directed attention to the need for railroads, but money was so scarce that for a long time it was impossible even to make a beginning in railway construction. However, in 1850 a company was formed and by 1855 thirty-two miles of track were completed from Harris-

[1] J. De Cordova says that: "This wagon-business is a great institution in Texas. His wagon is the home of the driver; his oxen feed on the grass; he eats and sleeps at home. Time is no object. He penetrates the most remote parts of the State, for a consideration, if he can get loaded; if not, he loads himself. He is free as air, and cares for nobody. These men form a class by themselves, but, with their useful branch of industry, are destined to fade away (like the old bargemen of the Mississippi River) when the snort of the iron horse shall awaken the solitude of the prairies." *Texas; Her Resources and her Public Men* (1858), p. 52.

burg to the Brazos River, opposite the town of Richmond. Soon thereafter the Houston and Texas Central [1] was completed from Houston to Hempstead, a distance of about fifty miles. As a means of encouraging the construction of railroads, the Legislature passed a law just previous to the Civil War conditionally offering railroad companies sixteen sections of land for every mile of track actually constructed. Loans were also made by the State from the school fund to assist in building railroads. Competing towns raised large donations by private subscriptions and, in some cases, counties and cities voted bonds to assist railroad companies in building their roads. At one time the Legislature authorized a State bond issue to certain railroads as an encouragement to extension and improvement, but the bonds were never actually issued and sold. Public lands were donated instead of the bonds. The rapid development of railroad building since 1880 has been largely due to the liberal policy of the State in donating public lands. This land grant policy to railroads was discontinued in 1882, but previous to this date nearly 36,000,000 acres of the public domain were patented by the railway companies. However, the failure of some of these companies to comply with legal patent requirements resulted in the loss of large amounts of this land.

Previous to the Civil War, a number of railroad companies secured charters, but only ten roads were

[1] Originally chartered as the Galveston and Red River Railroad.

actually started. The aggregate mileage previous to the Civil War was small. The outbreak of this struggle stopped all efforts at railroad building for a period of seven years. Construction during the war and early reconstruction days was not only discontinued but an actual decrease resulted in the mileage operated. One short road was torn up by the military forces, and unprofitable operation caused others to be abandoned. The most important of these was the Texas and New Orleans from Houston to Orange, which was abandoned entirely and not rebuilt until 1876.

For a few years following 1868 there was a revival of railroad building in the State, but the financial panic of 1873 resulted in the discontinuance of construction for several years. As financial conditions gradually became normal, building was resumed and by 1880 there were 3,000 miles of railway in actual operation.

The railroad mileage increased during the decade from 1880 to 1890 and by the latter date 8,654 miles had been built. The present mileage is given by the Railroad Commission as 16,120. This is a larger mileage than that of any other state in the United States, but this is largely due to the fact that the area of Texas is greater than that of any other state. There are still many sections that are inaccessible to railroads and agricultural development is being retarded because of inadequate transportation facilities.

There are 113 railway, terminal, and wharf companies in the State. The value of the roadways is

estimated at $150,586,223, of rolling stock at $30,870,053, and the value of intangible assets at $71,088,165.

The service of the railroads of Texas to the agricultural and live-stock industries varies with the resources of the section through which the several lines pass. The Missouri, Kansas and Texas Railway Company and the Gulf, Colorado and Sante Fe Company cross the State from north to south, the former terminating in San Antonio and the latter in Houston and Galveston. These roads serve the rich country of central Texas, supplying transportation facilities for the black prairies of the northern and central parts. The great Southern Pacific lines cross the entire State from southeast to west, through the southern part, and lateral lines of this system extend to central and northern Texas, providing freight transportation for lumber and oil from east Texas, cotton and grain from central Texas, and live-stock from the western part of the State. The Texas and Pacific crosses the State from northeast to southwest, through north-central Texas, supplying freight transportation for lumber, fruit, and other products from east Texas, cotton and grain from north Texas, and live-stock and other products from the western part. The International and Great Northern extends from northeast to southeast Texas, through Palestine, Austin and San Antonio to Laredo on the Rio Grande, providing transportation for lumber, fruit and cotton from the eastern part of the State, and live-stock and vegetables

from the southwestern part. The Fort Worth and Denver penetrates an important section from Fort Worth through northwest Texas, providing freight transportation for grain and live-stock. The Gulf Coast lines constitute an important railroad system, extending entirely across the State, penetrating the Gulf Coast and terminating at Brownsville. This road, like the International and Great Northern, is a connecting link between Texas and Mexico through the gateway at Brownsville. This road has been an important influence in the development of the vegetable and citrus-fruit section of the lower Rio Grande Valley. The cattle and rice industries of the Gulf Coast country have profited by the freight facilities of this road and the several branches of the Southern Pacific. Agriculture is also profitably served by the Chicago, Rock Island and Pacific Railroad Company, the St. Louis, Southwestern Railway Company of Texas (the Cotton-Belt Route), the St. Louis, San Francisco and Texas Railway Company, the San Antonio and Aransas Pass, and the San Antonio, Uvalde and Gulf Railroad Company, and other lines.

The percentage of principal commodities transported on Texas roads in 1920, which constitutes 60 per cent of the entire tonnage hauled, was as follows: wheat, 10.94; cotton, 3.17; cottonseed and products, except oil, 2.39; bituminous coal, 6.03; clay, gravel, sand, and stone, 10.93; crude petroleum, 4.57; other mine products, 1.98; lumber and timber, 9.70; and refined petroleum and its products, 10.43.

WATER TRANSPORTATION

Water transportation in Texas is principally confined to Gulf Coast points. In early days before railways became available, some of the rivers were utilized for the transportation of farm products to Gulf ports, where they were transferred to larger vessels for shipment to other sections of the country or to Europe. However, this method was gradually discontinued and freight and passenger transportation to interior points was confined to railways.

Galveston is the most important harbor of Texas. The Galveston ship channel, including the wharf front, has a length of about five miles and a width of about 1,200 feet. It originally had a depth varying from twenty to thirty feet at mean low tide, with the deepest part opposite Twentieth Street, and a width of about 500 feet below the eighteen-foot contours. The channel was navigable to Forty-first Street. Congress has provided appropriations in several river and harbor acts for deepening and widening this channel and harbor. The federal government has expended a total of $611,469.11 for dredging, improvements, and maintenance, and contributions amounting to $32,202.14 have been applied on this project, making a total expenditure of $643,671.25. The entire project of deepening and widening the channel is now about 42 per cent completed. A channel has been dredged from Galveston harbor at Fort Point to Forty-second Street, a distance of four miles, the least width being about 100 feet. This work is

being continued under available appropriations of Congress.[1]

The Galveston sea-wall, which is one of the most important and interesting engineering projects of the country, was begun June 20, 1918. This project has been conducted jointly by the State and federal government. The federal act made appropriations for this improvement conditional on the donation of 600 acres of land on the east side of Galveston Island and the provision of funds for the construction of at least 3,300 feet of sea-wall extension in addition to that to be undertaken by the federal government. The total expenditures on the existing project have been $3,097,940.62, of which the federal government has expended $2,680,591.99 and the contributing funds have amounted to $417,348.63. The Chief of Engineers of the United States Army has recommended to Congress that the sea-wall be extended to the south jetty.

The terminal facilities at Galveston are the most extensive on the Texas coast. They extend along the wharfs and channel for a distance of two and a half miles. The wharf system has sufficient capacity to furnish berthage for about sixty-three average sized ocean steamers at one time. There are several large grain elevators on the wharf front, the largest having a capacity of 1,600,000 bushels, another 1,000,000 bushels and the next two largest a capacity estimated at 650,000 bushels each.

[1] See Annual Report of the Chief of Engineers (1921), Part 1, p. 1024.

Galveston rose from ninth place in the tonnage entering the port and fifth in the tonnage shipped from the port in 1919 to fifth place in tonnage entering and to fourth in tonnage shipped out of the port in 1921.[1] The following tabulation indicates the importance of Galveston as a water transportation point:

NET TONS OF SHIPPING

1919		*1920*		*1921*	
Entered	*Cleared*	*Entered*	*Cleared*	*Entered*	*Cleared*
Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
1,182,919	1,420,575	2,426,687	2,838,982	2,789,196	3,403,416

The tonnage shipped from the port of Galveston includes cotton, grain, lumber, oil, and similar products.

Other harbors along the Gulf Coast include Texas City, on the mainland about seven and a half miles from Galveston; Port Bolivar, at the end of the peninsula by that name on the eastern coast of Texas; Freeport, at the mouth of the Brazos River; Port Aransas 180 miles southeast of Galveston and 132 miles north of the Rio Grande; and Brazos Island Harbor, which is at the extreme southern end of the coast of Texas, seven miles north of the mouth of the Rio Gande and about two and a half miles from Point Isabelle on the Texas Coast. This point is the terminus of the railroad from Brownsville.

In general, the streams of Texas are not navi-

[1] See Statistical Abstract of the United States (1921), p. 440.

gable very far up their courses in the interior, but improvements on the bayous and the larger streams near the coast have greatly increased the water transportation facilities of the State. The most important of these is the Houston Ship Channel. This extends in a northwesterly direction a distance of fifty miles to Galveston Bay, through the San Jacinto River and Buffalo Bayou to a turning basin at the head of Long Beach, terminating at Houston. The ruling depth of the channel at low tide is about twenty-five feet at the present time. The width of the channel varies within rather wide limits along its course. The total expenditure on the project of deepening this channel to date is $1,483,637.71, of which the federal government has expended $1,113,510.85 and the contributing funds have amounted to $370,126.86. These figures include both the construction and maintenance of the several projects connected with this improvement.

This channel has made Houston an important port. The City of Houston has constructed 3,626 linear feet of dockage at the turning basin and one of the best reinforced concrete warehouses covering five acres at the channel terminal in Houston. Other facilities are provided for storing cotton and other products awaiting shipment. There are 7.7 miles of terminal railroad tracks connecting the wharf front with the seventeen lines of railroads entering Houston. A municipal railroad is now being built to facilitate the handling of freight between the wharfs and the several railroad terminals. The channel

was opened to shipping in 1914. Water rates are now available to Houston, the port being on a parity with Galveston and Texas City, although 50 miles farther inland. A regular line of steamers plies between Houston and several ocean ports on the Atlantic seaboard. There are also regular sailings from the port of Houston to European ports, and oil tankers from two or three of the largest companies enter this port for crude oil to be transported to the refineries lower down the channel or to points on the Gulf Coast.

Important harbors are also maintained at Sabine Pass and Port Arthur. Sabine Pass is on the Gulf of Mexico, eighty miles east of Galveston and 435 miles west of New Orleans. The Port Arthur Canal is about seven miles long. Near its upper end the Sabine-Neches Canal joins it. Sabine Pass connects Sabine Lake with the Gulf of Mexico and is about seven miles long, varying in width from 1,700 to 5,000 feet.

Important and adequate shipping facilities are provided at Sabine Pass and Port Arthur. Both ports are important shipping points for grain and oil. At Port Arthur there is a grain elevator with a capacity of 550,000 bushels. The Standard Blue Book of Texas for 1920 reports that as a vessel-owning port, Port Arthur ranks first among all ports south of Baltimore, and at the present time over 125,000 tons of American shipping carry the name of Port Arthur as their home port. Statistics show that a total of 35,000 steamers come into this port

each year. At the water front at Port Arthur the Gulf Refining Company and the Texas Company own private docks. The port has a total of 11,000 linear feet of docks, part of concrete and part of timber construction.

On Taylor's Bayou above the Port Arthur turning basin, there are also modern wharfs and facilities for handling shipments of oil. Between the towns of Sabine and Sabine Pass there is a modern sulfur-loading plant consisting of a 400-foot wharf with conveyors and traveling cranes.

The Sabine-Neches Canal, in the extreme southeastern part of Texas, provides ocean transportation to Beaumont and Orange. It extends from the upper end of the Port Arthur Canal to the mouth of the Neches and Sabine rivers and up the former to Beaumont and the latter to Orange. The wharf facilities at Orange are principally used for the shipment of lumber. Lumber and oil are the principal products shipped from Beaumont. At Port Neches, on the Neches River, the Texas Company owns a wharf and storage facilities for the transportation of their own products.

West from Galveston along the Gulf Coast there are several important ports. Freeport, at the mouth of the Brazos River, is the principal shipping point for crude sulfur. There is also some general freight shipment maintained between this port and New York. A number of other harbors exist along the Gulf Coast, but they are relatively unimportant at the present time. The federal government has pro-

vided funds for the development of a number of these, and private wharfs have been established at accessible points. However, the shipments from these points are confined to small crafts and are largely used for transportation to the larger ports along the Gulf Coast.

Efforts to increase water transportation to the interior of the State have been made from time to time and federal appropriations have been provided for this purpose. The most important of these projects have been undertaken on the Brazos, Trinity, and Guadalupe rivers. The Trinity River has been partially improved to Dallas, a distance of 510 miles, although these improvements have not increased the transportation facilities along the course of the stream. The section of the Guadalupe River under improvement extends from Victoria to the mouth, a distance of only fifty-two miles. There are a few wharfs or landing places at various points along the river, but they are of little importance from the standpoint of freight transportation. However, at Seadrift, on the San Antonio Bay, there is a wharf that is used for shipping mud-shell and similar products. Efforts have been made to improve the Brazos from the mouth to Waco, a distance of 430 miles. These projects include the building of locks and dams, clearing the channel of obstructions and otherwise improving the stream for small craft transportation. One lock and dam has been completed by the federal government at Hidalgo Falls, seven miles from Navasota, and another one has been partially

finished. It has not been contemplated that the river would be navigable except during the winter months when the heavy, abnormal rainfall along the upper courses of the stream would increase its volume to such an extent as to make navigation possible for small boats. However, the river has not been utilized for any kind of shipping and the projects for improving the course of the stream have been discontinued by the federal government.

The West Galveston Bay and Brazos River Canal is the name given by the engineers to a channel extending in a southwesterly direction through West Galveston Bay and Oyster Bay and a canal connecting the latter with the Brazos River. The canal is about thirty-six miles long, parallel to and from one to four miles distance from the coastline of the Gulf. The channel is comparatively shallow and is only designed as a safe inland passage for light-draft boats and barges. There are no terminal facilities along the canal. It serves principally as the connecting link between the ports of Galveston, Freeport, Port Aransas, and other Gulf ports.

Another channel extends from the Brazos River near the termination of the Galveston and Brazos Canal to Matagorda Bay, a distance of thirty-two miles. This canal also parallels the coast line of the Gulf of Mexico about one and a half miles therefrom. At the Matagorda terminal of this canal there are wharf facilities. This canal has opened a clear waterway from Galveston to Corpus Christi, a distance of 202 miles, and has connected various natural

waterways along the coast with the Texas ports between Galveston and Port Aransas. While this intercoastal canal has not been of great importance as a transportation agency, it will probably increase in importance with the development of a proposed port at Corpus Christi. Provision has been made by the federal government, in coöperation with the State, to extend the channel from Aransas Pass through the depression known as Turtle Cove and through Corpus Christi Bay to the city on the west side of the bay, a distance of twenty-one and a half miles from Port Aransas. The improvement now contemplated is a renewal of previous projects that were only partially completed and discontinued some years ago.

HIGHWAYS

Railways are inadequate to meet the present demands for transportation of farm products. The evolution of transportation agencies from ox-drawn and horse-drawn vehicles to the motor-driven car and the truck has increasingly directed the attention to the need of hard-surfaced roads to supplement the steam trains. The concentration of population in urban centers has increased the need for rapid and dependable conveyance of food supplies from the farm to the local markets, and from there to the centers of population. It is almost as important to have an extensive system of improved highways connecting the farms with the local markets as it is to have railways joining the local markets with the towns

and cities. Improved highways accessible to every farm are essential to the solution of the problems of rapid and dependable transportation of agricultural products. Texas has 180,000 miles of public roads. Only 18,000 miles, or approximately 10 per cent, of this total are designated as State highways. Texas leads all other states in highway building, in the amount of federal aid for road construction, and the extent of work under construction at the present time. The federal appropriation available for highway construction in Texas amounts to approximately $32,000,000, but it should be recalled that Texas has such a vast area and such an extensive mileage of public highways that even with large available resources, it will be a long time before an adequate road system will be in operation. The great progress that has been made in highway construction is largely due to the present membership of the State Highway Commission. No department of the State government is being more efficiently administered. Great care has been exercised in designating State highways and if the program that has been outlined can be carried out successfully, Texas will ultimately have a system of highways that will make every part of the State reasonably accessible. (See Fig. 9.)

The Bureau of Public Roads of the United States Department of Agriculture in its annual report for 1922 shows that 10,000 miles of federal aid roads and more than an equal mileage of highways without federal assistance were constructed in 1922. According to this report, the greatest increase in completed

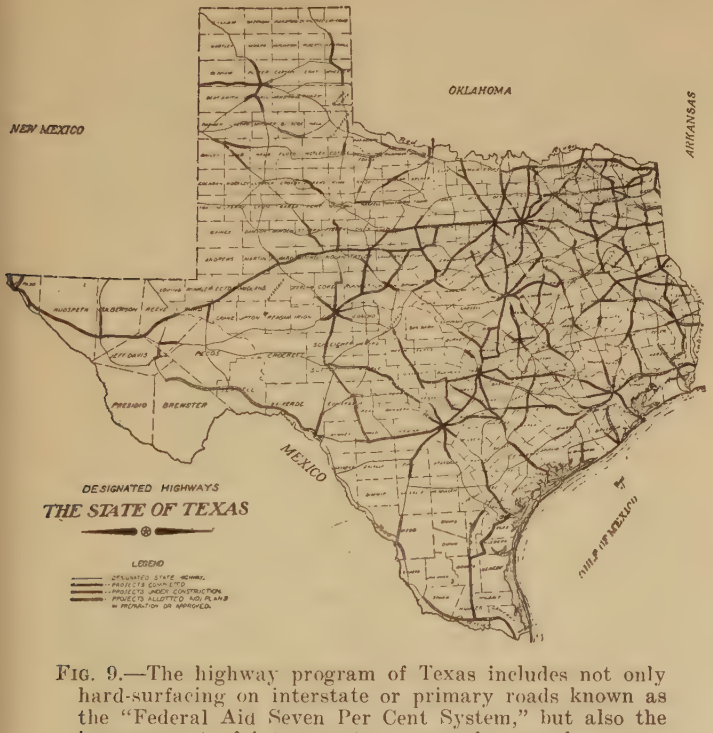

FIG. 9.—The highway program of Texas includes not only hard-surfacing on interstate or primary roads known as the "Federal Aid Seven Per Cent System," but also the improvement of inter-county or secondary roads.

mileage was in Texas, which added during the year 933 miles to her completed highways. The largest payment of federal aid during the year was made to Texas, which received from the federal government $5,915,046 and earned nearly $2,500,000 more. Ac-

cording to the State Highway Commission, of the mileage completed from December 1, 1920, to December 1, 1922, 184.36 miles were concrete; 240.6 were bituminous topped, or bituminous surface treatment on gravel or macadam basis; 13,092.45 were gravel or macadam surface; 201.48 consisted of sand clay, caliche, or shell surface; and 66.24 of grading and bridges only. In addition to this the Galveston causeway and fifteen bridge projects were completed.

On December 1, 1922, there was carried over into 1923 construction a total of 1,888.4 miles. The projects covered by this mileage are in the various stages of construction and all contracts provide for their completion on or before January 1, 1924. This 1,888.4 miles is divided into the following types: concrete, 45.79; brick pavement, 18.71; bituminous topped and surface treatment roads on gravel or macadam base, 698.11; gravel and macadam roads. 942.63; sand clay, caliche and shell roads, 58.73; graded earth roads with drainage structures, 124.4; and sixteen bridge projects.

The highway projects completed, contracted for and in process of construction, and additional projects for which funds are already available and plans are being prepared, include 6,244.41 miles of highways and involve a total expenditure of $74,945,-421.10. Federal aid is the source of $26,282,226.02 of this total, and direct state aid is the source of $10,008,592.90 of this cost. Fees and taxes on motor vehicles supply the funds for highway construction. The present highway laws base the license fee on the

PLATE VIII. Above, view of a grapefruit grove in the Rio Grande Valley. Below, a date palm in the Rio Grande Valley.

horse power of the automobile. For example, a twenty-five horse power passenger car is assessed at $8.75. It is contended by highway authorities that this fee is too low. According to the statistics, thirty-eight states assess a larger fee than Texas for motor vehicles. The Texas Highway Association is urging the Legislature to increase motor license fees. If this is done, the available revenues for highway construction and maintenance will be considerably increased. Texas stands seventh among the states of the Union in the number of cars and trucks registered by the Highway Department. In 1921 the number was 467,616 and this was increased to 526,569, or 12.6 per cent, in 1922.

At the present time the license fee on automobiles and trucks amounts to approximately $4,000,000. Of this amount $2,000,000 goes into the State Highway fund to be used as aid to assist counties on the roads, in the construction of which the federal government will not participate, and to help poorer counties match federal aid. The other $2,000,000 is returned to counties to be used for the purpose of maintaining roads on which State and federal aid has been extended. There is also a state and county ad valorem tax on automobiles which will approximate $2,000,000, estimated on the basis of an average of $4 a car. Assuming these figures to be approximately correct, the State has available from the motor vehicle tax and license approximately $6,000,000 for road construction and maintenance purposes.

The future of highway construction in Texas de-

pends on a change in the constitution of the State as a means of enabling the legislature to accept the provisions of the Federal Highway Act of July 9, 1921. Under the provisions of this act no funds from the national government will be available on a coöperative basis after November 21, 1926, unless the state provides for centralized control for the establishment, construction, and maintenance of the highway system. Under the present law, the several county commissioners' courts share with the State Highway Commission the responsibility of determining the location, character of construction, and the mileage of highways. A constitutional amendment in accord with this policy will be submitted to the people at an early date and it is reasonable to assume that it will be adopted. There is another provision of the federal act that is even more pressing than that of centralized control. Many counties in the State have expended large sums on the construction of roads without having taken the precaution to provide a maintenance fund to keep them in repair. Unless the roads are maintained, federal aid will be withdrawn. Under the present plan of operation, there are no available state funds that can be used for the upkeep of the highways already built. Therefore, the failure of county commissioners to maintain the roads already partially constructed at federal expense would result in the withdrawal of federal funds. This provision of the federal act is now in operation.

It is not to be presumed that a change in the

policy with reference to highway construction will relieve the counties of the responsibility of financing and building good roads. The present plan contemplates the construction of trunk highways throughout the State. It is equally important, however, for the several counties to provide funds for the building of hard-surfaced roads, extending to the remote places and providing transportation facilities for farm commodities. This particular problem has not been given serious consideration in the State. The needs of agriculture will not be adequately served until lateral lines branching off from trunk highways and extending to the most remote farming communities are constructed.

RURAL COMMUNICATION

Marketing and rural social life have been benefited greatly in recent years by the increase in rural mail facilities. Texas stands second, being exceeded only by Missouri, in the number of rural mail routes, and third, being surpassed only by Iowa and Idaho, in the mileage of rural routes. According to the annual report of the Postmaster General for the fiscal year ending June 30, 1921, there were 2,093 rural routes in Texas in 1920, which were increased to 2,128 in 1921. The mileage of rural routes increased from 56,300 in 1920 to 57,263 in 1921. The government is expending on rural mail deliveries in Texas more than $4,000,000. The United States official postal guide for 1922 gives a complete list of the towns,

with a corresponding number of rural routes. There is scarcely a section of the State that does not have some facilities for rural mail and package delivery. However, the vast area has made it impossible, up to the present time, to extend these rural mail routes to many of the more inaccessible sections. However, with the improvement of highways and the settlement of the less populous sections of the State, increasing facilities will be provided and the rural marketing and communicating systems will be improved.

The rural telephone is another agency of communication that has greatly improved rural living and marketing conditions. There is no clear line of demarkation between urban and rural telephone systems. The statistics relating to telephone communications are somewhat confusing. Earlier census figures classify all telephones in population centers of more than 4,000 as urban, and all other systems as rural. This classification, however, was unsatisfactory, because many of the systems that had their principal offices in places of 4,000 inhabitants, or more, extended their lines into the surrounding rural districts. The more satisfactory classification, which has more recently been adopted, is that of basing seggregation on the size of the companies or systems. Those companies that report an annual income of less than $5,000 are now classed as rural, and all others are designated as urban. No exact division between the two groups, however, can be made, even on this basis. Some of the smaller systems are located in the smaller cities and towns,

not infrequently operating in the same communities as the larger ones. On the other hand, many of the larger systems have extensive farm and rural lines which they own and operate and which form integral parts of their organization. This is frequently the case in Texas. There are a large number of small telephone companies operating in cities that maintain many miles of rural lines extending in all directions into country districts.

Based on this classification, the Bureau of the Census reports 5,127 rural telephone lines in the State, with a mileage of 138,608. The total number of telephones is estimated at 125,491. According to this report, Texas ranks first in the number of telephone systems, as well as in the number of miles of telephone wire used for this purpose. The total number of rural telephones is exceeded only by the states of Iowa and Missouri.

CHAPTER IX

RURAL MANUFACTURES OF TEXAS

The rural manufacturers of Texas depend largely for their raw materials on agricultural, live-stock, and mineral products. Manufacturing enterprises have been greatly stimulated by the rapid increase in the production of the raw materials within the State. That Texas offers unusual advantages for the investment of capital in manufacturing processes related to the raw materials produced on the farms and ranches has been emphasized often in official documents and the public press.

The Texas Almanac of 1871, for example, called attention to the "unequalled supply of hides and peltries for leather, and, in most parts of the state, a sufficient supply of tanning materials in oak barks, and in the west an inexhaustible supply of the tanning substance in the native mesquite, the entire tree being used for that purpose, and considered superior to any other material in the great rapidity with which it penetrates the thickest hides." Attention is further called in this same discussion to the opportunities in the State for the manufacture of boots, shoes, harness and saddlery. A logical and familiar note is sounded by the writer of this article when he says:

[illegible] the [illegible] [illegible] [illegible]

ucts of Texas was estimated at $70,434,000, while in 1909 it had increased to $272,896,000, a gain of nearly 300 per cent in twenty years. Texas advanced in manufacturing from twenty-fourth place among the states in 1900 to seventeenth in 1909. In 1919 the total value of manufacturing goods produced in the State was estimated at approximately a billion dollars, an increase of 220 per cent for the ten-year period. However, it should be borne in mind that the cost of materials in 1909 was $178,178,575, as contrasted with that of $701,170,898 in 1919. Thus it would seem that a large part of the growth in manufactures was due to an increase in the cost of raw materials. Notwithstanding this fact, however, there has been a remarkable increase in manufacturing in Texas during the past ten years.

While some of the manufacturing activities of the State lie beyond the scope of this discussion, a comparative summary of all manufacturing will help to emphasize the significance of those industries that are directly related to the making of agricultural and live-stock products.

The large increase in salaries, wages, cost of materials, and value of products from 1914 to 1919 as presented in the tabulation below is due chiefly to the change in industrial conditions brought about by the World War, and cannot be used to measure the growth of manufacturing from 1914 to 1919. However, the increase that is shown in the number of persons employed and the horse power of the machin-

COMPARATIVE SUMMARY: 1919, 1914, 1909

	Manufacturing Industries			*Per Cent Increase*		
	1919	*1914*	*1909*	*1914 1919*	*1909 1914*	*1904 1909*
Number of establishments	5,724	5,084	4,588	12.6	10.8	45.3
Persons engaged	130,911	91,114	84,575	43.7	7.7	46.1
Proprietors and firm member	5,393	4,787	4,496	12.7	6.5	46.3
Salaried employees	17,996	11,474	9,849	56.8	16.5	71.2
Wage earners (Av. No.) ...	107,522	74,848	70,230	43.6	6.6	43.1
Primary horsepower	443,207	335,791	282,471	32.0	18.9	71.6
Capital	$585,776,451	$283,543,820	$216,875,579	106.6	30.7	87.5
Salaries and wages	147,907,778	59,179,344	48,774,827	149.9	21.3	59.5
Salaries	31,503,978	14,357,967	10,867,555	119.4	32.1	77.6
Wages	116,403,800	44,821,377	37,907,272	159.7	18.2	54.9
Paid for contract work	3,067,813	1,342,170	1,324,435	128.6	1.3	—9.0
Rent and taxes	15,912,226	3,939,184	2,618,836	303.9	50.4	....
Cost of materials.....	701,170,898	253,144,261	178,178,515	177.0	42.1	94.5
Value of products	999,995,796	361,279,303	272,895,635	176.8	32.4	81.3
Value added by manufacture..	298,824,898	108,135,042	94,717,120	176.3	14.2	60.7

A minus (—) sign denotes decrease.

ery used does more or less accurately indicate the growth in the manufacturing activities of the State. The increase in "rent and taxes" is rather significant because this item includes the federal income tax since 1914 and this tax is largely derived from the manufacturing industry.

A number of the establishments listed in the census reports cannot be classed as rural manufacturing enterprises. There are also a number, like farm implement factories, that contribute to the efficiency of agricultural production but are not appropriately included in the agricultural manufacturing establishments of the State.

However, a few intermediate agencies that are essential factors in the manufacturing processes should be included under this classification. The cotton gin is a good illustration of this type. Ginning is the first step in the preparation of the cotton fiber for spinning, and the condition in which the lint comes from the gin has an important effect on its value as a future manufactured product. Increasing attention has been given in Texas to the condition of gin machinery and the operation of gins, both as to feeding and speed, for the purpose of giving the fiber the best possible grade.

There were 3,840 cotton gins in Texas in 1921 and 1922, according to the report of the Commissioner of Warehouse and Markets for the year ended August 31, 1922. Of this number 430 were not in operation. The Bureau of the Census reports 3,592 active and 455 idle cotton gins in the State in 1920. Two types

of machines are now used for separating the cotton fiber from the seed—the roller and the saw gins. The latter is the modern and generally used type. However, the roller gin is well adapted for use in removing lint from seed easily detached, such as Sea Island and American Egyptian cotton. As one would expect, the counties reporting the largest number of gins are those of largest cotton production. For example, Ellis County reports 74 gins, Williamson 70, McLennan 69, Hill 59, Navarro 59, Milam 57, Rusk 57, Lamar 56, Collins 56, Kaufman 55, Hunt 53, and Smith 51. Cotton gins are operated by individual farm owners, gin companies, and, in some cases, by cottonseed oil companies. On large plantations in Texas gin capacity is designed to meet only the needs of the plantation owner, but in most cases gins are of sufficient capacity to serve community needs, or at least, those of the several cotton producers in the immediate vicinity of the gin. In recent years some opposition has developed to the ownership, or controlling interest, of cotton oil mill owners in gins. Bills have been introduced from time to time in the Legislature proposing to compel the separation of gin and cotton oil mill ownership, but there has not been sufficient sentiment in the Legislature or throughout the State to secure the passage of this legislation.

The fact that Texas is the largest producer of cotton has long been the argument for the establishment of cotton mills in the State. Economy of effort and money would certainly result from a coördination of ginning, baling, warehousing, and manufacturing

of cotton materials in the midst of the vast area of production.

While this argument for cotton manufacturing has been generally accepted as valid, the State has developed its cotton manufacturing industry very slowly. Texas produced 4,200,000 bales of cotton in 1920, but only 64,333 bales were transformed into merchantable fabric during that year. This is slightly more than 1½ per cent of the production, and the fabrics were generally of very low grade. In contrast with this situation, the cotton-growing states of the South manufactured 3,582,919 bales into clothing and the United States transformed 6,419,734 bales into finished products. In other words, almost half of the cotton goods manufactured in the United States is restricted to the New England states where no cotton is grown.

As previously stated, labor and fuel problems have been largely responsible for the slow development of manufacturing, especially of cotton, in Texas, but gradually these difficulties are being overcome. Mexican help has been tried out at the San Antonio cotton mill and has proved more satisfactory than was anticipated. There are other sources of mill operators that may be drawn on as the industry develops. The fuel problem is gradually being solved by the increasing available supply of fuel oil, natural gas, and lignite.

In 1904 a building was erected at the Agricultural and Mechanical College of Texas and courses in the manufacture of cotton textiles have been continu-

ously offered since that time. The graduates in Textile Enginering have been in demand as superintendents of textile plants and they have helped to increase interest in the industry. Courses in cotton classing and grading are also being offered. The farmers of the State, as a result of the educational activities at the College, are becoming more and more impressed with the relation between grade and staple and the manufacturing qualities of cotton. The textile mill at the institution and its correlated educational activities are, therefore, contributing largely to the production of better qualities of raw cotton, and to the number of available men for executive officers and mill superintendents.

The following is a list of the cotton mills in operation in Texas:[1]

Belton Yarn Mills, Belton, capitalized for $100,000, producing high grade hosiery and underwear and yards, sizes 14's-30's. This mill has 10,096 spindles.

The Bonham Cotton Mills, Bonham (Consolidated Textile Corporation), capitalized for $200,000; has 15,500 ring spindles and 433 looms, and produces brown sheeting.

South Texas Cotton Mills, Brenham, capitalized for $50,000; has 7,000 spindles and 200 looms, and produces duck and osnaburgs.

Corsicana Cotton Mills, Corsicana, capitalized for $100,000; has 11,000 spindles and 200 looms, and produces flat duck and osnaburgs.

[1] Bull. 27 of the Texas Engineering Exp. Sta., entitled "Cotton Mill Development in Texas," by J. B. Bagley, Professor of Textile Engineering.

Navarro Manufacturing Company, Corsicana, capitalized for $15,000; has 2,500 spindles, and produces yarn from 4's to 12's.

The Guadalupe Valley Cotton Mills, Cuero, capitalized for $270,000; has 8,300 spindles and 172 looms, and produces coarse sheeting and double and single filling duck.

Dallas Cotton Mills, Dallas, capitalized for $250,000; has 12,556 spindles and 312 looms, and produces single filling duck, drills and osnaburgs.

Denison Cotton Mill Company, Denison, capitalized for $350,000; has 14,000 spindles and 325 looms, and produces cotton duck, sheeting and drills.

Gonzales Cotton Mill Company, Gonzales, capitalized for $200,000; has 6,000 spindles and 150 looms, and produces duck, sheeting and osnaburgs.

Hillsboro Cotton Mill, Hillsboro, capitalized for $90,000; has 6,500 spindles and 180 looms, and produces duck.

Itasca Cotton Manufacturing Company, Itasca, capitalized for $150,000; has 7,396 ring spindles, 200 200 looms, and produces drills, osnaburgs and duck.

Kingsville Cotton Mills, Kingsville, has 5,000 spindles, and is making cotton twines.

Texas Cotton Mill Company, McKinney, capitalized for $440,000; has 11,072 spindles and 396 looms, and produces cheviots, denims, pin checks and awning stripes.

Postex Cotton Mill Company, Post, capitalized for $555,000; has 10,000 spindles, 296 looms, and produces bleached bed sheeting and pillow cases.

San Antonio Cotton Mills, San Antonio, have a mill at Southton. This mill has 2,500 spindles and

60 looms, producing 60-inch osnaburgs and ducks. No figures on capitalization are given.

Star Cotton Mills, San Antonio, has a mill in the old Star Brewery. It has 10,000 spindles and 325 looms, producing chambrays.

Sherman Manufacturing Company, Sherman, capitalized for $100,000; has 8,000 spindles, 48 broad and 168 narrow looms, and produces single filling duck.

Miller Cotton Mills, Waco, capitalized for $1,000,000; has 5,000 spindles and 200 looms, and produces denims.

Waco Twine Mills, Waco, capitalized for $150,000; produces cotton twine.

Waxahachie Cotton Mills, Waxahachie, capitalized for $200,000; has 10,000 spindles and 150 narrow and 98 broad looms, producing ducks and osnaburgs.

Brazos Valley Cotton Mills, West, capitalized for $100,000; has 6,240 ring spindles and 210 looms, and produces duck and osnaburgs.

For a long time the utilization of cottonseed was a problem on the farm. In the early history of the cotton industry the seed was regarded as of little value and on most farms the surplus seed was left in large heaps in the open field to decay, and large accumulations of seed about the gins involved actual expense to remove and destroy them.

Some experiments were made before the Civil War in the use of seed for fertilizer and feeding, but these did not result in giving seed great commercial value. Crushing seed for oil had its beginning just before the Civil War. In 1859 there were seven

plants in the United States engaged in the manufacture of seed products. After the Civil War the demand for fertilizer in the eastern states of the cotton-belt resulted in the increased consumption of cottonseed for this purpose. It was not until 1875 that refined cottonseed oil was sold on the New Orleans market.[1] The first cottonseed oil mill in Texas was built at Navasota about this time and it has been in continuous operation since its establishment. The number of cottonseed oil mills have multiplied rapidly during the last two decades. Since that time the cottonseed industry has developed very rapidly in the cotton-growing states.

The seed-crushing industry, unlike cotton milling, has had its principal development in the states where its raw material is produced. The principal reason for this is that about two-thirds of the weight of cotton as it is picked is seed. Cottonseed, being bulky and heavy, makes long shipment for manufacturing into commercial products unprofitable. Therefore, cotton oil mills have been built in the immediate sections of large production and contiguous to gins.

The four primary products from crushing cottonseed are linters, hulls, cake, and oil. Linters are the short lint or fur that is removed from seed by a delinting machine. The hulls are removed from the kernels, and the oil is expressed from the kernels by hydraulic presses. The residue which is called "cake" is ground into cottonseed meal. In the "cold-press" mills the whole seed is crushed into one compact

[1] Yearbook, U. S. Dept. Agr. for 1921.

mass. All the primary products, except linters, are finished commercial products.

In 1905 the Legislature passed a law regulating the sale of concentrated commercial feed stuffs, and the material from which they are manufactured.[1] This act defined the several kinds of concentrated feeds and prohibited their adulteration as defined in the act. The Director of the Agricultural Experiment Station of the Agricultural and Mechanical College is charged with the administration of this act, and this officer is given authority to adopt standards and enforce the provisions of the law.

This law has been very beneficial to feeders of concentrated feed stuffs by regulating and defining the products manufactured by cottonseed crushing establishments. The Texas Cottonseed Crushers' Association has exerted its influence to sustain the standards of commercial feed, and in recent years there have been comparatively few violations of the provisions of the Feed Control Law.

Texas has approximately 204 cottonseed oil mills. These mills differ greatly in capacity. Twenty-seven crush less than 1,000 tons annually, thirty-three crush between 1,000 and 2,000 tons annually, sixty-seven between 2,000 and 5,000 tons, fifty-five from 5,000 to 10,000 tons, nineteen 1,000 to 20,000 tons and three over 20,000 tons annually. Houston, Dallas, and San Antonio are the three largest seed-

[1] See Chap. 108 of the Acts of the Twenty-ninth Legislature, and Chap. 131 of the Acts of the Thirtieth Legislature amending the Original Act.

crushing centers. The cottonseed oil cake produced at Dallas was valued at $7,691,521 for 1920; Houston manufactured $9,374,602 worth of cake, and San Antonio produced $2,083,599 worth. Houston produced 9.2 per cent of the oil and cake of the State for 1920, Dallas, 7.2 per cent, and San Antonio, 2 per cent of the total production.

PRODUCTS OBTAINED

Year	*Crude Oil (Gallons)*	*Cake and Meal (Tons)*	*Hulls (Tons)*
1920	50,924,000	539,000	390,000
1919	38,168,000	449,000	306,000

The value of the crude oil produced from cottonseed by Texas crushers in 1920 was $26,506,000; of cake and meal $17,814,000; of hulls, $2,302,000. Texas yielded 1,934,000 tons of seed in 1920 whose total value was estimated at $41,350,000. The value of the three manufactured products for that year exceeded the total value of seed produced by $5,272,000, although, of course, not all the cottonseed was crushed.

The profitableness of the seed-crushing industry may be roughly approximated by estimating the value added to the product by manufacturing. In 1912 there were 217 mills whose capital valuation was estimated at $21,506,000. In that year the industry paid $29,916,000 for the seed crushed, and yielded a product valued at $36,393,000. In other words, the value added by manufacturing was $6,477,000. In 1920 with a capital investment of ap-

proximately that of 1912, the industry produced a product valued at $102,112,000. The value added by manufacturing was estimated at $14,979,000. The returns on capital investment in seed-crushing plants vary within wide limits. The smaller plants, as a rule, are less profitable than the larger ones, due to overhead expense and other causes. Cottonseed crushers of the State insist that their business has not been profitable in recent years. An effort has been made in the Legislature to exempt cotton oil mills from taxation for a period of years as a means of encouraging the industry, but this effort has failed to secure the approval of the Legislature.

The cottonseed industry is an essential one of the State and deserves the encouragement of the people. It has contributed largely to the development of the dairy and beef cattle business by providing an adequate supply of concentrated feeds where grass is scarce as a result of winter weather or drought conditions. There is certain to be considerable reorganization of the oil mill business before it is on a stable and profitable basis, but the essential nature of the industry insures its permanence in Texas.

The production of cane sirup on individual farms for home consumption has existed for many years in Texas. The commercial manufacture of this product has not been practiced on a large scale, although there is one establishment that produces considerable quantities of sirup and refined sugar. Some sirup is also made from sugar-cane, but this is

negligible and the product is only used for home consumption.

Texas farmers planted 294,000 acres of cane in 1922 and harvested for sirup only 21,600 acres. The State produced 3,192,000 gallons of cane sirup in 1921, and 2,485,000 gallons in 1922. The industry is not on a stable basis but an effort is being made to increase cane sirup production.

At the present time Texas produces less than a third of the sirup consumed by her people and, yet, northeast, east and southeast Texas could raise enough sirup of the highest standard and grade to supply the needs of the whole nation. The Markets and Warehouse Department of Texas has recently made an effort to establish uniformity of grade, flavor, color, container, and pack of ribbon cane sirup, with a view to improving the market quality of the product. The natural adaptability of many Texas soils to the production of cane and the standardization of the product are certain to increase the importance of this industry.

The importance of the live-stock industry made it inevitable that meat packeries should be established in the State. The Texas Almanac for 1871 under the title of "Meat for the Millions" discusses the expense of the refrigerating process employed in preserving a thousand beeves for delivery in New Orleans from Texas points. The writer concludes that "the profits on the business of transporting fresh beef from Texas to the great markets, under the refrigerating process, are from thirty to fifty times

as great as the profits on packing." The problem of the cost of transportation and the conditions under which beef products could be transported best continued to vex the live-stock producers over a long period. The curing of meat in "smoke-houses" was almost universal in early days in Texas, and the practice has continued until recent times. However, with the development of the packing industry and the location of packing-houses in the commercial centers of the corn-belt and in a few selected localities of the cotton-belt the domestic curing of meat has almost ceased.

In 1919, 1,904,581 cattle and calves were slaughtered on farms and 224,780,189 pounds of beef and veal were sold from the farms during the same year. In 1918, Texas shipped 86,455 carloads of cattle to markets. The State ranked third in the number of carload shipments that year, being exceeded only by Nebraska and Illinois. Fort Worth stood fourth in the list of sixty-seven markets in the receipts of cattle and calves on the basis of an annual five-year average period from 1916 to 1920, the number being 1,421,205. Most of the cattle received at the market centers are sold to packeries for slaughter, but large numbers are also sold to farmers for stockers and feeders. Fort Worth ranked ninth in the number of cattle slaughtered under federal inspection [1] in the leading markets in the twelve-month period from July, 1920, to June, 1921, the number being 267,473.

[1] The number of cattle slaughtered under federal inspection is about two-thirds of the total number slaughtered in the United States.

The cattle and calves received at the Fort Worth market in 1921 numbered 984,000, of which 576,000 were slaughtered and 172,000 were sold for stocker and feeder cattle.

While Fort Worth is the oldest and the largest meat-packing center in the State, there are four other cities with important meat-packing establishments. According to an estimate of the Institute of American Meat Packers of Chicago, the following figures indicate the relative importance of Texas cities as meat-packing centers:

	Cattle	*Calves*	*Sheep*	*Hogs*
Amarillo[1]	802	317	....	....
Dallas	7,643	1,607	585	56,324
El Paso	21,044	....	6,973	10,552
Fort Worth	557,575	251,532	206,447	322,194
San Antonio	36,938	17,333	1,861	15,835

[1] The packing plant at Amarillo has temporarily suspended operation.

The census of 1920 reports that slaughtering and meat-packing rank second in the value of products of all manufacturing industries in Texas, and tenth in the slaughtering and meat-packing industries of the United States. The growth of the industry is indicated by the number of animals slaughtered at the several packing establishments in the State which increased from 1,554,102 in 1914 to 1,751,507 in 1919. The number of industries in the State was reported by the census at nineteen (census figures include a few small plants not included in the list

of the Census of American Flour Factory; the number of wage earners employed was 1,872, and the value of products was estimated at $121,172,000.

The principal grain-mill product in Texas is wheat flour. This comprises 72.2 per cent of the total value of all the products from that industry. Most of the small grain crops of the United States are consumed or exported in large quantities without first being milled. For example, 208,971,000 bushels of wheat were exported from the United States in 1920. The transportation of this vast amount requires the erection of large grain elevators at terminal markets and elevators throughout the wheat-producing area. These elevators of large capacity are located at railroad and at other important shipping and manufacturing centers.

Flour mills also occupy an important place as an industry. The per capita consumption of flour is large in the United States, and great quantities of flour, as well as wheat, are exported. In 1920, 11,-211,000 barrels of flour, valued at $74,470,000, were exported from the United States. Texas produces large quantities of flour, most of it of very high quality, for both domestic and foreign consumption. The last census reports 1,267,673 barrels of flour milled in the State in 1919. This was valued at $11,-141,000. The production of 715,000 pounds of cornmeal and corn flour, valued at $1,014,000, was also reported for that year. The total value of all flour and gristmill products in the State was estimated at more than $13,000,000, which was an increase of

value of approximately 100 per cent in the ten-year period from 1910 to 1920.

The milling of rice is of comparatively recent development in Texas, but with the increase in the growth of rice the industry has assumed considerable importance. Texas, with fourteen establishments, ranks with California and is exceeded only by Louisiana, with forty-six, in the number of rice-milling plants. The total value of the product in Texas was estimated at $17,901,000 in 1919, of which $4,091,000 was the value added by the processes of preparing the product for market. In 1919, 319,765,950 pounds of rough rice were treated, the value being estimated at $17,900,547.

The production of timber in Texas has long been an industry of great importance. The annual output has exceeded a billion board feet since 1905. The largest cut on record was 2,229,590,000 feet in 1907. In 1919 Texas ranked eighth among the states in the production of lumber and seventh in 1909 and 1914. The cut for 1919 decreased 11.2 per cent compared to that of 1914, and 34.3 per cent compared to that of 1909. Texas ranked fourth in 1919 in the production of yellow pine lumber, the number of feet being 1,330,734,000. This was 96.4 per cent of the total cut for the State from all sources. The hardwood lumber industry, of which oak is the principal source, was next in importance, being 28,605,000 feet, or 2.1 per cent of the total production. Texas produces considerable quantities of lumber from gum, cypress, tupelo, maple and ash.

Other agricultural manufactures listed by the census include bread and bakery establishments, numbering 610, which manufactured a product valued at $20,000,000 in 1919; coffee roasting and grading, numbering forty-one, with a product valued at $7,851,000; thirty-one commercial plants producing butter whose value was estimated at $7,161,000; five cement plants putting out a product valued at $4,743,000; 126 marble and stone establishments producing materials valued at $2,159,000; nine peanut grading, roasting and shelling plants whose products were valued at $2,055,000; nine fertilizer plants with products valued at $1,593,000; eighteen pickle and preserving plants whose products were valued at $1,297,000; forty-five plants for producing brooms from broom-corn, the total output having a value of $1,247,000; and nine canning and preserving establishments whose manufactured products of fruits and vegetables were valued at $617,000.

CHAPTER X

AGRICULTURAL FINANCE AND MARKETING IN TEXAS

Agricultural wealth, credit, and marketing are important economic aspects of agricultural endeavor. No appraisal of rural life would be complete that failed to evaluate these factors. A knowledge of the distribution of wealth devoted to agricultural enterprise, the credit facilities available for capital, and the marketing agencies and facilities that are being utilized is essential to an adequate understanding of agricultural prosperity.

AGRICULTURAL WEALTH AND INCOME

The prosperity of agriculture as a business enterprise can best be determined by a comparison of the aggregate capital invested and the net income derived from this investment. While the data relating to this aspect of Texas agriculture are not complete, nevertheless, the statistics that are available will give an approximation of the relative significance of agricultural wealth and income.

The value of all farm property and its distribution

between land and buildings, implements and machinery, and live-stock for each of the last four decades is indicated by the table on page 278, taken from the last census.

The total value of all farm property in the United States was estimated at $77,924,100,338 in 1919. Texas ranked second in 1919 in the total value of agricultural property, being exceeded only by Illinois. The State stood third in the value of land, being exceeded only by Illinois and Nebraska; tenth in the value of farm building property; eighth in the value of farm implements and machinery; and second in the value of live-stock on farms. This comparison indicates that in proportion to the total agricultural wealth, Texas farms are not as well equipped as they should be.

A closer approximation of farm values is indicated by the census figures showing the value of each farm and the average value an acre, as follows:

AVERAGE ACREAGE AND AVERAGE VALUE A FARM: 1890 TO 1920 [1]

Census Year	Average Acreage a Farm		Average Value a Farm			
	All Land	Improved Land	All Farm Property	Land and Buildings	Implements and machinery	Live-Stock
1920	261.5	71.6	$10,200	$8,486	$354	$1,360
1910	269.1	65.5	5,311	4,412	136	763
1900	357.2	55.6	2,733	1,964	85	683
1890	225.3	90.9	2,420	1,753	60	607

[1] See special bulletin of the Fourteenth Census on Texas Agriculture, Table 4, p. 3.

VALUE OF FARM PROPERTY: 1890 TO 1920 [1]

Census Year	All Farm Property		Land and Buildings		Implements and Machinery		Live Stock	
	Value	% of increase	Value	% of increase	Value	% of increase	Value	% of increase
1920 ..	$4,447,420,321	100.5	$3,700,173,319	100.7	$154,320,996	171.7	$592,926,006	86.1
1910 ..	2,218,645,164	130.5	1,843,208,395	166.4	56,790,260	88.5	318,646,509	32.5
1900 ..	962,476,273	74.3	691,773,613	73.0	30,125,705	119.2	240,576,955	73.8
1890 ..	552,127,104	115.6	399,971,289	134.6	13,746,541	51.9	138,409,274	80.8

[1] See special bulletin of the Fourteenth Census on Texas Agriculture, Table 3, p. 3.

It will be observed that during the past decade farm values increased approximately 100 per cent, but comparatively Texas ranks low in the average value a farm and the average value of land and buildings to the acre. Texas is exceeded by a number of states in the average number of acres to a farm, which partially accounts for the difference in the average value of a farm. On the basis of the average value of land and buildings to an acre Texas is exceeded by thirty-five states. Seven states report an average value of land and buildings in excess of $100 an acre. These figures indicate that land values in Texas are still comparatively low and that for the next few years money invested in Texas farm lands should yield good returns on the investment in the form of increased land values.

The Fourteenth Census contains a table [1] showing the average value of farms and buildings and the average value an acre, based on acreage groups.

AVERAGE VALUE OF LAND AND BUILDINGS

	Per Farm		*Per Acre*	
Size Group	*1920*	*1910*	*1920*	*1910*
Total	$8,486	$4,412	$32.45	$16.39
Under 20 acres	1,790	918	159.79	81.81
20 to 49 acres	2,577	1,141	78.16	34.81
50 to 99 acres	5,319	2,385	77.78	34.70
100 to 174 acres	8,535	3,952	66.09	30.45
175 to 499 acres	13,317	6,595	49.14	24.43
500 to 999 acres	22,111	12,242	32.94	18.22
1,000 acres and over	73,992	46,374	12.88	8.02

[1] See special bulletin of the Fourteenth Census on Texas Agriculture, Table 9, p. 4.

As one would expect, the average value of land and buildings to a farm increases with the size of the farms, but the large increase from the "500 to 999 acres" group to the "1,000 acres and over" is due to the inclusion of the large ranches in west Texas in the latter category. The values are reversed in the last two columns of the table above. The highest average value an acre is in the smallest acreage group, and there is a continual decline in the average acreage value of each group, the last having an average value of land and buildings of only $12.88 in 1920. This is due to the relatively low value of grazing lands and the comparatively inexpensive building improvements that exist on many ranches, in contrast with the more fertile land and more expensive building equipment on the small acreage groups.

The value of the farm crops and animal products derived from the capital investment of Texas in agriculture is larger than that of any other state. The State ranks first in the total value of all products, first in farm crops alone, second in live-stock and sixth in the value of its live-stock products. The following table gives the comparative value of Texas crops for the past three years and the average for the preceding five-year period.

Number of Crops	*1916-1920 (000 Omitted)*	*1919 (000 Omitted)*	*1921 (000 Omitted)*	*1922 (000 Omitted)*
Value of 22 leading crops	$711,030	$885,955	$352,564	$594,619
Estimated value of all crops	856,663	1,071,542	459,300	755,000

The estimated value of animal products was $252,000,000 in 1921, and $246,500,000 in 1922. If these figures are added to the value of field crops for the corresponding years, the total of all products is $1,356,203,715 in 1919, $711,300,000 in 1921, and $1,001,500,000 in 1922.[1] The rapid decline in the prices of farm products is indicated in the total values for 1921. The gradual increase in prices is suggested by the total value of farm products for 1922, but the figures clearly indicate that prices at that time were still far below the five-year average for 1916 to 1920.

It should be recalled that farm values and farm sales are never the same for any particular year. Farm values are based on production. Farm sales are always less than farm values for a particular year, as all products are never sold during the year they are raised. In a state like Texas where a non-perishable crop, like cotton, constitutes approximately half of the value of the agricultural production, there is likely to be a large difference between production and sale values.

It is necessary to keep in mind also that the measure of agricultural prosperity cannot be determined by the productive values of the farm crops. Productive value is quite different from farm and labor income, and in final analysis this income is the

[1] The United States Department of Agriculture collects data on the sale of all farm products under four classifications. It was found that in 1920, out of every $100 received from the sales of Texas crops, $16 was for live-stock, $9 for live-stock products, $72 for crops, and $3 for miscellaneous sales.

most accurate measure of rural prosperity. Farm income is the difference between receipts and expenditures in conducting the enterprise. It represents the amount of money available to the farmer above the value of family labor, provided he has no interest to pay on mortgages or other indebtedness. Labor income is the amount the farmer has left for his own compensation after 5 per cent interest on the farm investment is deducted from the income. It is the total wage after the earning power of the farm has been deducted. In years of high cost of production and low prices for farm products, agricultural enterprise is relatively unprofitable; conversely, in years of low cost of production and high prices for farm products, agricultural enterprise is relatively profitable. The Texas farmer produced the 1920 crop at high cost. The decline in prices, therefore, made farming unprofitable for that year. The crop of 1922, on the other hand, was produced at low cost, due to restricted credit and other causes, and the gradual recovery of prices enabled the farmer to regain part of his losses for the two preceding years.

Reliable information on the farm and labor income of Texas farmers is not available, but the general effect can be approximated from facts that are rather well known. The prices of staple farm products were violently affected by the European War. The beginning of the war in 1914 cut off the supply of food stuffs from Russia and the Balkan countries to Europe. The price of grain in the United States was influenced promptly. Wheat rose steadily from 1914

to 1920. In January of 1920 the highest price was reached and wheat sold on the Chicago market for $2.50 to $3.50 a bushel. Live-stock prices also advanced rapidly from 1913 to 1919. In contrast with grain and live-stock, cotton was unfavorably affected by the war. During the fiscal years 1910 to 1914 the average exports of cotton were about 9,300,000 bales, but from 1915 to 1921 they were under 6,000,000 bales. Immediately on the outbreak of the war there was a rapid decline in the price of cotton, but gradually the price recovered as unfavorable crop conditions resulted in the decline in cotton production. The price of cotton gradually increased from a little over eleven cents in 1914 to slightly over forty-three cents in July, 1920, but between July and December of 1920 the price declined to less than eleven cents. As cotton is the most important money crop in Texas, these price changes greatly affected the prosperity of Texas farmers. The agricultural producers of Texas never fully shared in the general benefits of high prices, as drought conditions and insect depredations during the years of high prices so reduced production as to limit the opportunity to share in these benefits. The Texas farmer, therefore, was not as well prepared as those of other states to endure the hardships resulting from the deflation of prices that took place between 1920 and 1921. It will require several years with good yields of farm products and fair prices for the Texas farmers to regain their pre-war financial status.

FARM INDEBTEDNESS

It might be supposed that during the period of good prices and agricultural prosperity the farmers would reduce their indebtedness of all kinds—pay off their mortgages and notes. "On the contrary," says George E. Roberts, vice-president of the National City Bank of New York, in an address before the Academy of Political Science in New York on November 24, 1922, "the aggregate farm mortgage indebtedness of the country was very largely increased in this time, the increase in some of the most prosperous states being more than 100 per cent between the censuses of 1910 and 1920." This statement applies to Texas, but the increase in farm indebtedness was not so great as that indicated in the figures referred to by Roberts. The percentage of owned farms mortgaged in Texas increased from 30 per cent in 1890 to 37 per cent in 1920. The census of 1920 reports a total of 201,210 owned farms in the State. Of this number, 69,940 farms were mortgaged, which was an increase of 5,932 over the census of 1910. The figures become more impressive when the increase in mortgage debt and the average increase in mortgage indebtedness are considered. The Fourteenth Census gives these figures as in table on page 285.

Twelve counties of the State have a mortgage indebtedness of more than $2,000,000. Forty-one additional counties report an indebtedness of more than $1,000,000. The table on page 286 gives the counties with the largest mortgage indebtedness, as

reported in the 1920 census. As a basis of comparison, the value of all farm lands and buildings of the counties are also given.

MORTGAGE DEBT: 1920 AND 1910 [1]

Item	Owned Farms Mortgaged		Increase	
	1920	1910	Amount	Per Cent
Number of farms reporting amount of debt	57,700	58,024	9,676	20.1
Value of land and buildings	$664,522,579	$297,880,832	$366,641,747	123.1
Amount of mortgage debt	172,166,818	76,089,272	96,077,546	126.3
Ratio of debt to value, per cent	25.9	25.5	....	....
Average rate of interest paid, per cent	7.3	....	....	....
Average value per farm	$11,517	$6,203	$5,314	85.7
Average debt per farm	2,984	1,584	1,400	88.4
Average equity per farm	8,533	4,619	3,914	84.7

Probably the capital investment (value of all property, including permanent improvements) in agriculture as represented by the counties in the table

[1] See special bulletin of the Fourteenth Census on Texas Agriculture, Table 20, p. 6.

County	Value of Land and Buildings	Mortgage Indebtedness
Archer	$7,461,738	$2,173,473
Collins	8,816,824	2,467,602
Dallas	9,175,313	2,338,122
Denton	9,392,001	2,529,079
Ellis	12,763,976	3,242,189
Grayson	9,325,255	2,541,534
Hidalgo	8,302,304	2,375,979
Hill	12,041,167	2,979,178
Hunt	8,340,482	2,333,390
Lavaca	6,184,353	2,082,633
McLennan	8,401,216	2,649,901
Williamson	8,356,102	2,227,041

above is not bearing an undue burden, if the mortgage indebtedness represents the total financial obligation. However, the working capital (cost of machinery, live-stock and supplies) utilized on Texas farms is also largely provided by loans from local banks and other credit agencies. These obligations increase the burden on agricultural enterprise and the high rates of interest on short term loans also add to the financial burden of the farm. The total farm mortgage and short-time loans in Texas increased from $160,870,000 in 1918 to $267,772,000 in 1920. The effect of this rapid expansion of credit followed by a rapid decline in the prices of farm products has seriously affected the prosperity of Texas farmers.

RURAL CREDIT

Credit institutions and facilities to meet the requirements of agriculture have increased rapidly in recent years. Previous to 1913 practically no

attention had been given to the special credit needs of agriculture. Since that time Congress and the several state legislatures have given earnest consideration to credit institutions to meet the needs of short-term personal credit, intermediate credit, and long term credit. The credit needs of Texas farmers are now supplied by the Federal Reserve Bank at Dallas, with 675 national banks and 983 state banks, ninety of which are affiliated with the Federal Reserve Bank. The Farm Loan Bank of Houston and the numerous national farm loan associations throughout the State are supplying the needs of Texas farmers with long-term credit. The four joint stock banks, which include the First Texas Joint Stock Land Bank of Houston, the Joint Stock Land Bank of Dallas, the First Trust Joint Stock Land Bank of Dallas and the San Antonio Joint Stock Land Bank, are supplying credit also to farmers under the provisions of the Farm Loan Act. Intermediate credit for live-stock production, farm machinery and equipment, is now available to Texas farmers under the provisions of the Farm Loan Act passed by Congress in March of 1923. The Federal Intermediate Bank, with a $5,000,000 capitalization, has been organized in connection with the Farm Loan Bank of Houston. The National Agricultural Credit Corporation, authorized under the provisions of this act, will also supply additional large scale intermediate credit in connection with the live-stock industry in western Texas.

A rural credit union law was passed by the Legisla-

ture of Texas in 1913. This was the first effort to improve the credit conditions of Texas farmers. The object of this law was to promote thrift among the members of the union and to provide them with credit facilities at reasonable interest rates by reducing the financial risk of the borrowers. The Texas act outlines a plan of organization, defines the scope of financial activities, and definitely restricts loans to productive purposes. The rural credit union law has not been an effective means of promoting thrift or providing a credit agency for farmers. It is claimed that this is due to the fact that the control of the union has been placed under the Commissioner of Banking and Insurance, who is not primarily interested in this plan of credit. There are those who favor the placing of the control of the union as established under the provisions of this act under the Commissioner of Markets and Warehouses, or some other agricultural agency of the State. It is claimed that the North Carolina plan of placing these unions under the Commissioner of Agriculture has worked much more satisfactorily. Whatever the cause, this law has not been effective as an agricultural credit agency in Texas. The other credit institutions have been much more efficient in supplying Texas farmers with credit. The increasing demands made on these institutions in recent years have been a rather good test of the effectiveness of rural credit enterprises.

Inflation and the relatively high prices of farm products during the war period resulted in a rapid

PLATE IX. A native pecan orchard in west Texas. This is typical of many similar orchards to be seen in various parts of the State.

rise in the price of farm lands. Farmers, like those engaged in commercial and industrial enterprises, yielded to the temptation to speculate. Farm credit rapidly expanded for a time. Warnings followed by the threats of the Federal Reserve Banks to restrict credit to productive purposes had little effect at first, but the debacle of prices in 1920 and 1921 caused the farmers to experience the most serious financial distress. Incomes were inadequate to pay off obligations that had been incurred, and restrictions placed on credit by the Reserve Bank caused wide-spread criticisms. These criticisms were largely responsible for the appointment of the Joint Congressional Commission on Agricultural Inquiry in 1921. This commission undertook to determine by actual investigation the answer to the following questions:

1. Whether the expansion of bank loans in rural districts during the four or five years culminating with June, 1920, was more or less rapid than the increase of such loans in the financial and industrial centers.
2. Whether the action of the Federal Reserve Board during the fifteen months preceding June 30, 1920, produced a greater curtailment of credit in the rural districts than in the financial and industrial sections.
3. Whether credit was absorbed from the rural communities and placed at the disposal of the financial centers for the purpose of speculative activities.

The conclusion of the report of this commission was that "in general the expansion in the agricultural

states during the period of inflation was at least as great, if not greater, than in the industrial states." [1] The Commission modified this conclusion by stating that "the information is indicative rather than conclusive," as it was impossible to separate completely industrial and agricultural loans.

The facts brought out in the report of the Commission on Agricultural Inquiry with reference to Texas tend to support the general conclusion, although it appears that there was greater restriction on farm credit in Texas than in other agricultural states. However, loans and discounts in Texas increased from $325,676,000 in 1914 to $826,057,000 in 1920, or 153 per cent. This percentage was only exceeded by South Carolina, Alabama, Mississippi, Louisiana, Arkansas, South Dakota, Wyoming, New Mexico, Oklahoma, Idaho and Arizona. In an effort to separate the loans for industrial and agricultural purposes, the Congressional Commission directed an inquiry to the rural banks. After eliminating the banks of the larger cities of Texas, it was found that the banks primarily serving agriculture throughout the State increased their loans and discounts from $317,752,000 in 1914, to $784,115,000 in 1921, or 142.8 per cent.

In order to ascertain further the credit facilities that were available for agriculture, the Commission made a study of ten rural counties of the State. It was found that in ten counties loans and discounts

[1] Part II, p. 100, Report of the Joint Commission of Agricultural Inquiry.

increased from $37,013,518 in 1914 to $84,124,250 in 1920, or 127 per cent.

The expansion of credit during the first two years following the war showed the efforts of the credit institutions of the State to meet the financial needs of the farmer. Loans and discounts as reported by all banks in the State increased from $502,559,000 in 1918 to $746,279,000 in 1920. Farm mortgage loans increased from $15,228,000 in 1918 to $15,596,124 in 1920, or 3.3 per cent in 1918 and 2.09 per cent in 1920. Personal and collateral loans rose from $145,642,000 in 1918 to $252,176,368 in 1920, or 28.98 per cent of the total loans in 1918 and 33.79 per cent in 1920. The total farm mortgage and short term loans increased from $160,870,000 in 1918 to $267,772,000 in 1920, or an increase of 66.4 per cent in the period from 1918 to 1920.

It seems, therefore, that the general conclusion of the Congressional Commission on Agricultural Inquiry is substantially correct in so far as Texas is concerned. There seems to have been slightly more restriction placed on credit in Texas than in some of the corn-belt states. However, the Federal Reserve system has justified itself as an adaptable financial agency in a period of stress. It is necessary to recall that the Federal Reserve system began operations in 1914—soon after the beginning of the European War. The Reserve system was new to the fianancial and business interests of the country. Its machinery had to be developed rapidly to meet the financial strain resulting from war conditions.

It was inevitable that the system was to experience difficulty and criticism, but it saved the United States from much of the financial distress experienced in European countries. Agriculture is especially indebted to the Reserve system for financial assistance when credit was most needed.

The long-term credit needs of Texas farmers have been reasonably well met by the Federal Land Bank of Houston. This bank was organized under the provisions of the Farm Loan Act passed by Congress in 1916. The Federal Farm Loan Banks began to function in 1917. The operations of these banks were temporarily suspended, due to a suit brought by hostile interests which attacked the validity of the act. This suit was filed in the Federal Courts in 1919 and the decision upholding the validity of the act was not made until the spring of 1921. Notwithstanding this interruption, the Federal Land Bank of Houston had made loans in excess of $75,000,000 to more than 26,000 farmers, with a saving to them of interest charges alone of more than $2,500,000 a year. For the twelve months ending December 31, 1922, loans were made approximating $24,000,000. During the months of December, 1922, and January, 1923, loans were granted in excess of $7,000,000. Since that date loans have been made averaging approximately $2,000,000 a month. These figures are sufficient to indicate that the Federal Land Bank of Houston is supplying adequate long-term credit for Texas farmers.

The Farm Loan Banks have shared with all other

credit agencies in the financial distress resulting from low prices of farm products and deflation. Some Texas farmers have not been able to meet their obligations with the Federal Land Bank of Houston, but only four foreclosures have been necessary since the bank began operation.

The service of the Farm Loan Banks will be greatly extended by the operations of the Intermediate Credit Banks, to which reference has been made, provided for in the Rural Credit Law passed by Congress in March of 1923. One of these Intermediate Credit Banks is to be established in connection with each of the twelve Federal Land Banks of the United States. These banks will provide intermediate credit, extending from three months to three years. An initial capital stock, supplied by the government, of $5,000,000 will be available for each intermediate credit bank. These banks will take for rediscount farmers' notes presented by banks and by farmers' coöperative associations. This act also provides for the establishment of National Agricultural Credit Corporations to be under the control of the Comptroller of the Currency. A corporation of this kind can be formed by farmers, business men or bankers with a minimum capitalization of $250,000. These corporations can raise more money by floating debenture bonds. It is contemplated that these institutions will supply intermediate credit for large scale loans. The law also provides for privately capitalized rediscounting corporations in connection with the smaller institutions. It is assumed that National

Agricultural Credit Corporations will be organized in the more important cattle marketing centers of the State, like Fort Worth, Amarillo and Houston.

AGRICULTURAL MARKETING

Texas has been making rapid progress in marketing farm products in recent years. The prosperity of agricultural producers has been so vitally affected by poor marketing practices that Texas farmers have been willing to try almost any kind of experiment that offers any promise of success.

Marketing made little progress in Texas previous to 1920. Farm organizations from time to time have undertaken to form coöperative marketing agencies, but for one cause or another most of them have failed. As a means of assisting the farmer to market his products more profitably, the Legislature has placed certain responsibilities on the Department of Agriculture and the Department of Markets and Warehouses of the State. The Division of Markets of the former agency is charged with enforcement of the standardization law providing for uniform containers for fruits and vegetables and the packing, grading, and inspection of these products for market. The latter agency has been charged by law with supplying the farmers with market information and standardizing grades of farm products.

The most important effort in marketing farm products is that of coöperative commodity marketing, which had its substantial beginning in 1920. In that

year the Farm Bureau Federation invited Aaron Sapiro, a California lawyer who had made a careful study of the Danish system of coöperative marketing and who had been for some years the legal representative of a number of California coöperative marketing associations, to come to Texas and assist in working out a similar plan of marketing Texas farm products. A number of agricultural leaders of the State met with Sapiro in Dallas. After a conference of two days, definite steps were taken to organize a coöperative cotton marketing association. The task was not easy of accomplishment. In the first place it was necessary to secure the passage of certain legislation. Secondly, to induce a sufficient number of farmers to sign the coöperative agreement to make the plan effective involved a great amount of work. In the third place, the plan contemplated radical changes in financing cotton farm operations. This aroused the concern of the bankers, merchants, and landlords. Fourthly, the time was short in which to organize in order to get the plan in operation for marketing the crop for 1921.

A bill providing for the organization of coöperative marketing associations was submitted to the Thirty-seventh Legislature in January of 1921. This bill provided for the organization of purely coöperative marketing associations, defining their rights, duties and policies, prescribing who may organize such marketing associations, and carefully defining the powers that may be exercised by these associations. This act received the approval of the Legislature and

became a law, under which the several marketing agencies of the State have been organized.

The first coöperative marketing association organized by the Farm Bureau Federation under the provisions of this law was the Texas Farm Bureau Cotton Association. A membership campaign was organized in the early spring of 1921 and by July 1 approximately 20,000 members, representing an annual production of more than 500,000 bales of cotton, had joined the Association.

The plan of organization is purely coöperative and is patterned after the most successful farmers' associations of California. It is based on the following fundamental principles and policies.

(1) Organization by commodity and not by locality. Experience has demonstrated that the locality type of organization cannot successfully market a product produced over a large area. The marketing organization must reach out over the whole area of production. The Farm Bureau, therefore, not only attempted to organize the Cotton Cooperative Marketing Association in Texas, but cotton marketing associations have been organized throughout the Southern States under the name of the American Cotton Growers' Exchange. This organization was formed in April, 1921. Texas, Arizona and Oklahoma were the first members. Five additional states entered the Exchange in 1922, making a total of eight states that sold cotton coöperatively. Four additional states are in process of organization.

(2) Farmers' marketing associations must be business organizations composed of farmers only, con-

trolled by farmer boards of directors with no adverse interest in its membership or governing body.

(3) Internal pooling of all products handled by the association. By this is meant that cotton of all members sold through the association must be graded and all cotton of each grade constitutes a separate pool. As these pools are sold, payments are made to members according to the cotton delivered to the several pools. All members whose cotton is of the same grade and staple receive the same price. No member receives for all his cotton the highest price of the year and no member receives the lowest price of the year, but all share equally in all sales throughout the season from pools into which their cotton goes, according to the number of bales contributed by each. This puts all members upon the basis of equality and protects them from speculative breaks in the markets and insures more stable and dependable return to growers. This policy is an attempt to substitute merchandising for the old policy of "dumping" cotton on the market.

(4) Long time binding contracts with members. The marketing agreement between the cotton producers and the Texas Farm Bureau Cotton Association provides that "this agreement shall be binding upon the grower as long as he produces cotton directly or indirectly, or has the legal right to exercise control of any commercial cotton or any interest therein, during the term of this contract." The term of contract at present is for a period of five years. This provision of the marketing agreement has been opposed by many cotton farmers, but many advocates of coöperative marketing insist that this is the only way to give continuity to the business

of merchandising farm products and is essential to the success of the undertaking.

(5) Employ experts in all departments. The plan of the organization contemplates employment of experts to conduct the marketing activities and to finance the operations of the cotton association. An effort has been made to secure the most experienced men in all departments of the business.

The time has been too short to appraise the merits and benefits of the coöperative commodity marketing plan of the Texas Farm Bureau Federation. It is frankly admitted by the officers of the Association that some mistakes were made in the beginning of the enterprise, but considering the short time in which the plans were set into operation, the results already attained seem to give promise of permanent success.

The result of two years' work on the program of commodity marketing has been the organization of coöperative associations to market fourteen of the State's staple farm products, comprising more than seventy coöperative corporations chartered under the State law to which reference has been made. These organizations are as follows:

Texas Farm Bureau Cotton Association
Southwestern Farm Bureau Wool and Mohair Association
Texas Farm Bureau Hay Association
Elephant Butte Alfalfa Association
Texas Wheat Association

Texas Farm Bureau Watermelon Association
Texas Farm Bureau Sweet Potato Growers' Exchange
Southwestern Poultry Producers' Association
Texas Farm Bureau Onion Growers' Exchange
North Texas Farm Bureau Dairymen's Association
Texas Farm Bureau Ribbon Cane Syrup Association
Texas Farm Bureau Grain Sorghum Growers' Association.
Cattle Raisers and Producers' Commission Company. (Organized in coöperation with Texas and Southwestern Cattle Raisers' Association.)
Texas Farm Bureau Pecan Growers' Exchange. (In process of organization.)

None of these organizations has been in operation long enough to determine definitely its success, but most of them give promise of at least improving the present marketing situation of farm products in Texas. The information available indicates hopeful attitudes on the part of those directly interested in these organizations. For example, the secretary of the Sweet Potato Growers' Exchange states that "the drought in the fall of 1922 made such a shortage in stock until our showing is very poor, but we have cut overhead expenses to the minimum and hope to assure a success of it." The Texas Wheat Growers' Association was incorporated on May 20, 1922, and it now has a membership of about 1,200. The secretary advises that the Association "controls about four million bushels of wheat and we are growing at the rate of about a hundred new members per month."

The Texas Grain Sorghum Association was not incorporated until January, 1923. Its membership is already sufficient to control about two million bushels of grain sorghums and this organization advises that it expects to control a good percentage of the grain sorghum crop this year (1923). The El Paso Valley Bartlett Pear Association reports that the membership includes all the pear-growers of the section and all car shipments are sent through this organization. The Association also handles spray materials and other supplies for its members. It was organized in 1916 and during the past three years has averaged a price of $2.68 a box, f.o.b., loading station, for top grade Bartlett pears. The Elephant Butte Alfalfa Association reports that it was organized in May, 1921, and is now handling about 30 per cent of the alfalfa grown in El Paso County and adjoining counties in New Mexico. This Association also has a subsidiary warehousing company for the storing of the alfalfa of its members. The El Paso warehouse has a capacity of 10,000 tons. The annual report of the Southwestern Farm Bureau Wool and Mohair Association shows that the organization consists of 170 members, and averaged a total of about 500,000 pounds of wool and mohair for marketing in 1921. The report further states that "the grading was done by government licensed graders who knew none of the growers and could not have shown partiality. This is the first time in the history of Texas growers that an attempt has been made to grade and sell wool on its merits."

CHAPTER XI

AGRICULTURAL ORGANIZATIONS AND FAIRS

Texas has been a prolific field for agricultural organizations. One after another has arisen, attracted local or general attention for a time and then gradually declined, and finally ceased to exist. Farm organizations have usually had their origin in times of financial depression. As a rule, their numbers and influence follow the trend of the changing fortunes of the agricultural producers. They attain their maximum membership and exert their greatest influence during periods of financial distress, and gradually decline in numbers and influence as prosperity is restored.

Agrarian movements of every kind have received more or less encouragement in Texas. The extent of the resources and direct influence of financial conditions of the agricultural population on the general prosperity of the State explain why this is true.

The "Grange" was the first significant organizations of farmers in Texas. This developed out of the financial distress experienced by the farmers during the period from 1870 to 1873. The farmers were very antagonistic toward the railroads because of high

freight rates and low prices of farm products. Inability to meet their obligations and the foreclosing of many farm mortgages, thereby depriving them of their homes, caused the greatest discontent. These conditions caused the rapid spread of the Grange throughout the country. "By the end of 1873," says Kile, "the Grange was organized in all but four states in the Union—Connecticut, Rhode Island, Delaware and Nevada." [1]

The conditions of the times were reflected in the "Declaration of Purposes of the National Grange," one of which was to discountenance "the credit system, the fashion system and every system tending to prodigality and bankruptcy." The Grange flourished in Texas for a time, but gradually the organization declined with the restoration of prosperity. While the Grange continues to maintain an organization in a number of states, it has long since ceased to exist in Texas.

The Farmers' Alliance had its origin in Texas. This organization began to gain strength about 1885 after the decline of the Grange. It was first called "The Texas State Alliance," but as it spread to other states the name was changed to "Southern Alliance," and soon thereafter to the "Northwest Alliance." This organization promoted some cooperative activities. It also exerted considerable political influence for a short period. An effort was made to unite the various state Alliance groups into a national organization and a convention was held

[1] *The Farm Bureau Movement* (1921), Chapter 2, p. 14.

for this purpose at St. Louis in 1889, but the effort was unsuccessful. The organization joined the hands of organized labor "for mutual defense and protection, as well as for united political action." The Farmers' Alliance favored the abolition of national banks, free coinage of silver, government ownership of public utilities and legal prohibition of dealing in futures of farm products, especially in the case of cotton. The "People's Party" was a direct product of the political doctrines of the Farmers' Alliance and many farmers who were members of the Alliance or in sympathy with its purpose joined this party. The People's Party exerted considerable influence in Texas and throughout the Middle West in the years immediately following 1890.

The Texas Alliance was succeeded by the Farmers' Educational and Coöperative Union of America. This organization was founded in 1902. It was the outgrowth of the modest effort of Newt Gresham, of Emory, Texas, who "determined to make at least one desperate effort in behalf of the farmers of his neighborhood." [1] This organization is reported to have saved the farmers of Raines County, Texas, about $6,000 through a "ginners' contract." Nearly $500 was also saved by collective shipping of cottonseed. As a result of these modest successes, the membership increased rapidly throughout the State and soon extended to other states. "To a considerable extent," says Kile, "the Union was built upon the ruins of the Farmers' Alliance. In thousands of communities

[1] See Kile, *op. cit.*, Chapter 2, p. 30.

the locals of the wrecked Alliance still existed as independent units and when the organizers of the Farmers' Union came along, offered them a state and national affiliation, and invited them to join in another crusade, they eagerly accepted." [1]

By 1914 the Farmers' Union had a well established organization in twenty states of the South and Middle West and in Oregon and Washington of the Northwest. The dominating purposes may be summarized from the constitution as follows:

"To secure equity, establish justice and apply the Golden Rule.

"To discourage the credit mortgage system.

"To assist our members in buying and selling.

"To educate the agricultural classes in scientific farming.

"To teach farmers the classification of crops, domestic economy, and marketing methods.

"To systematize methods of production and distribution.

"To eliminate gambling in farm products by Boards of Trade, cotton exchanges, and other speculators.

"To bring farming up to the standard of other industries and businesses.

"To secure and maintain profitable and uniform prices for cotton, grain, live-stock, and other products of the farm.

"To strive for harmony and good will among all mankind and brotherly love among ourselves.

"To garner the tears of the distressed, the blood

[1] *Idem*, Chapter 2, p. 30.

of the martyrs, the laughter of innocent childhood, the sweat of honest labor, and the virtue of a happy home as the brightest jewels known."

Unlike the Farmers' Alliance, the Farmers' Union was not organized for political purposes. In fact, the charter of the first local in Texas was abrogated because its members violated this principle. The Farmers' Union has placed most of its emphasis on agricultural and economic problems, rather than on the social and educational features of its program. The organization has owned and operated a number of coöperative stores. Farmers' Union warehouses have been operated in Texas and other cotton-growing states of the South. Some success has been attained in Texas by the organizations for coöperative marketing of cotton and other products.

The Texas Farm Bureau Federation is one of the most recent and, at the present time, the most active and influential farm organizations in Texas. This evolved out of the Texas Council of Agriculture and Home Economics which was organized at Waco in 1919. The Farm Bureau Federation was organized at Dallas in October of 1920. J. T. Orr, of Dallas, was selected for the presidency and C. O. Moser, of the same county, was made secretary. The Farm Bureau idea was not new in this country. County Farm Bureaus had become numerous and active in many of the states previous to 1920, and in some states these organizations had crystallized into state associations. New York, California, Minnesota,

West Virginia, and Vermont were among the first to federate county Farm Bureaus into state organizations. Texas, therefore, was not without precedent or guidance in the establishing of a Farm Bureau Federation, but the plan of development in Texas was somewhat different from that in some of the other states. The development of county Farm Bureaus had not made very much progress in Texas previous to the establishment of the state organization. Instead of the latter being the outgrowth of the county Farm Bureaus, it was formed first and assumed responsibility for the organization of the county units.

The constitution of the Texas Farm Bureau Federation states its general purposes in the following words: "The chief aims and purposes of this Association are to voice the aspirations and to assert the rights and defend the interests of the agricultural producers of Texas; and to coöperate with similar Associations in other states in rendering a like service to the entire agriculture of the Nation." The specific aims and purposes as set forth in the constitution may be summarized as follows:

(1) To effect such changes and improvements in the existing system of marketing and distributing agricultural products as will bring to producers a fair profit on their investment of labor and capital and, at the same time, insure a fair price unswelled by waste, inefficiency and graft.

(2) To study marketing conditions and to set up coöperative commodity marketing institutions to

handle specific commodities and groups of commodities.

(3) To contend for such additional changes and modifications in the credit institutions and facilities as will enable agricultural producers to have as adequate credit facilities as are now afforded to those engaged in industrial enterprises.

(4) To strive for better and fairer transportation rules and charges for the transportation of agricultural products.

Within two years after the establishment of the Texas Farm Bureau Federation, county Farm Bureaus had been organized in more than 150 counties. The membership has been very active. The marketing program was formulated by Walton Peteet, formerly Specialist in Rural Organization in the Extension Service of the Agricultural and Mechanical College of Texas. His services have been invaluable in the organization of the several commodity marketing associations that have been established since the Farm Bureau Federation.

The Texas Farm Bureau is closely coördinated with the American Farm Bureau Federation. The Texas organization has fully supported the national legislative policies of the American Farm Bureau. John Orr, President of the Texas Farm Bureau Federation, is a member of the Executive Committee of the national organization.

The Farm Bureau Federation has worked in close coöperation with the Extension Service of the Agricultural and Mechanical College. The President of

the College and the Director of the Extension Service have been members of the Board of Directors of the Farm Bureau Federation since its organization. The relations between the activities of the Farm Bureau and the Extension Service were defined in a memorandum of understanding between the Executive Committee of the American Farm Bureau Federation and the States Relation Service of the United States Department of Agriculture in 1921. While there has been no conflict between the interests of the Farm Bureau and the Extension Service in Texas, the basis of coöperation outlined in this memorandum of understanding has been strictly adhered to. The result has been that the two agencies have worked in close coöperation without either trespassing on the functions and duties of the other. It is generally understood that the Extension Service is not expected to engage in marketing activities, while the Farm Bureau has given large emphasis to this phase of its work. It is also generally recognized that since the Extension Service is an agency of the state and federal government, coöperation and assistance must be extended to all farm organizations and to individual farmers impartially.

The Farm Labor Union of America was organized at Bonham on October 30, 1920—in the same month and year as the Farm Bureau Federation in Dallas. The preamble to the constitution suggests the purposes that resulted in the formation of this organization. It reads as follows: "We, farmers and farm laborers, who produce the farm products for every

living creature, and without which no one could survive, from the inmate of the county infirmary to the king in his palace, are and have been slaves for years for the manufacturers, the gamblers and speculators of every type, who have priced the products of our labor and have taken it from us at their own price and at their will, allowing us but a mere scant living; thus bringing tenantry, illiteracy and misery to us while enriching themselves and filling their coffers with the wealth that rightly belongs to the producers."

The Farm Labor Union has held two conventions. The first convened at Fort Worth on November 30, 1921, and the second at the same place on December 6, 1922. The last convention was reported to have been attended by from 400 to 500 delegates, principally from Texas, Oklahoma, Arkansas, and Mississippi. The by-laws and constitutional committee was composed of the following farm representatives: J. L. Neil of Bell County, L. L. Rhodes of Van Zandt County, Lee Tapley of Fannin County, R. A. Calloway of Hopkins County, and Will Glidewell of Grayson County. A representative of the four brotherhoods of engineers, firemen, switchmen and conductors and a representative of the American Federation of Labor were also placed on this committee. W. W. Fitzwater of Bonham has served as President of the organization since its first meeting. The other officers elected at the last meeting in Fort Worth were G. H. Haton, vice-president, and Claude McClure, of Bonham, Texas, secretary.

The specific purposes of the organization may be summarized from the constitution as follows:

(1) It is a business organization of farmers, designed to take their business out of the hands of the speculators and gamblers and price-fixers, and fix the price of their products at cost of production plus a reasonable profit.

(2) A plan for agreeing upon prices to be charged for farm products is definitely outlined.

(3) The plan for orderly marketing is outlined as follows: "When the ginning season opens the members of the Farm Labor Union of America shall request the ginner to use a black buckle on every other bale of his cotton. The cotton with the black buckle is unsalable until the following January 1, at which time the black buckle cotton will be offered to the world's market with the understanding that there will be one cent per pound added to the previous price for all cotton not sold in the hands of the Farm Labor Union of America, on and after February 20 of each respective year."

(4) The employment of graders and salesmen is provided for.

(5) A plan for determining the acreage to be planted in the several field crops, based on available surplus, is carefully outlined.

(6) Membership in the organization is restricted to actual laborers or producers of farm products.

In 1922 the Fort Worth convention formulated plans for a coöperative cotton marketing system. This contemplates the shipping of cotton from the primary markets to convenient and accessible market

centers or ports. At these points the cotton is to be placed in warehouses and insured. The shipper is to be allowed the selection of his own cotton factor. If necessary, he may call on his exporter to finance him, pending the sale of his cotton. Semi-annually a price is to be fixed on cotton, based on the cost of production plus a reasonable profit. A similar plan is contemplated in connection with the marketing of grain and other products. This plan differs in many essential respects from that of the Farm Bureau Coöperative Cotton Association.

A state branch of the Farm Labor Union of America was organized at Fort Worth on the last day of the national convention. A. M. Hilliard of Van Zandt County was elected president, J. J. Murray of Hopkins County vice-president and Mrs. Aurelia Smart of Palo Pinto County was elected secretary. An executive committee consisting of six members was also appointed. This committee was directed to prepare a constitution and by-laws for the state organization.

The Farm Labor Union has grown rapidly in Texas since its organization in 1920. Its greatest increase in numbers has been in north and northeast Texas. Its future will depend largely on the success of its marketing plans. Its influence at present is restricted to four or five southwestern states. It remains to be seen whether the organization will be able to become national in scope.

There are a number of farm organizations in Texas whose purpose is to promote special agricul-

tural and live-stock industries. These include the following:

The Texas Horticultural Society is one of the oldest farm organizations in the State. It was the outgrowth of several sectional horticultural societies that united their forces and formed a state-wide organization in 1886. Some of the most prominent men connected with Texas agriculture have served as officers and promoted the objects of this association. The members of the State Horticultural Society were largely responsible for the organization of the Texas Farmers' Congress, which met annually at the Agricultural and Mechanical College and exerted an important influence on the progress of Texas agriculture. This society has also been responsible for the establishing of the Texas Nurserymen's and the Texas Florists' Associations.

The membership in the Rural Land Owners' Association is largely restricted to land owners in south and southwest Texas. Its objects are set forth in its constitution as follows: "This furtherance of all measures, political, economic or commercial, tending to promote beneficial enterprises in the legitimate management, ownership and settlement of lands. To combat all measures, political, economical or commercial, placing unnecessary burdens or improper restrictions upon land ownership, management or settlement." In conformity with these purposes the Rural Land Owners' Association has adopted a declaration of principles that includes fair and just taxation, protection of home owners, assistance in

the "marketing of crops, the handling and marketing of live-stock and united effort in the advancement of the prosperity of producers and stock raisers."

In the summer of 1916 a group of seventy-nine beekeepers from nineteen counties met at San Antonio for the purpose of discussing the problems of honey production in Texas. The Texas Honey Producers' Association grew out of this meeting. The organization now numbers several hundred members scattered throughout the honey-producing area of the State. San Antonio is its headquarters.

The Texas and Southwestern Cattle Raisers' Association is one of the most important and influential organizations in Texas. Its object is to promote the prosperity of the live-stock producers. It has, therefore, fostered beneficial legislation to this end, and in recent years it has given increasing consideration to problems of live-stock marketing. The Association holds an annual convention which is largely attended. Fort Worth is the headquarters.

Membership in the Sheep and Goat Raisers' Association is largely confined to the southwestern part of the State where sheep and goat raising is an important industry. The Association holds an annual convention, usually at some important town in the sheep and goat raising section. These conventions are well attended and important problems relating to the industry are considered. San Angelo is the headquarters.

While the Texas Swine Breeders' Association is one of the oldest farm organizations of the State, it was

not incorporated until 1919. The objects, as its name indicates, are the promotion of scientific breeding and the furtherance of the interests of breeders and shippers of hogs. It has a large membership composed of the leading swine breeders of the State.

Associations promoting special breeds of live-stock include the Texas Jersey Cattle Club, the Holstein-Friesian Breeders' Club of Texas, the Texas Hereford Association, the Texas Shorthorn Breeders' Association and the Texas Aberdeen-Angus Association.

AGRICULTURAL FAIRS AND LIVE-STOCK EXHIBITIONS

Agriculture in Texas has been promoted by the enterprise of cities and towns through county, district and state fairs, where agricultural products and live-stock have been exhibited and marketed. These fairs and exhibitions have had the effect of increasing the interest of the farmers in better quality of farm products and live-stock.

The State Fair of Texas is the oldest. It is held for a period of practically two weeks in the fall of each year in Dallas. This fair dates back to the days of the Confederacy. On January 9, 1862, the Ninth Legislature of Texas in a special session passed unanimously an act incorporating the Dallas County Fair. This was the beginning of fairs in this State. A board of directors was appointed and arrangements were under way for the first fair, but during this time the Confederate government made a call for

troops and every member of this association responded to the call.

In the early days of the reconstruction period following the Civil War, little was accomplished toward the reorganization of the fair. However, in 1872 the county fair was launched for the second time, with W. H. Gaston as president. In January of 1886 a charter was granted for the "Dallas State Fair and Exposition Association." The first annual fair was held October 26 to November 6, 1886, with James B. Simpson president and Captain Sidney Smith secretary, on the eighty-acre tract of land that comprises the present site in Dallas. The live-stock exhibits for the first year consisted of long-horn steers, razorback hogs and broncho horses, while the chief agricultural exhibit was cotton.

The growth of the fair was slow for the first few years. Very little, if any, improvement was made in the exhibits. Up to this time little attention had been given to pure-bred live-stock in the State. However, after a few years breeders in other states came to realize the advantage of opening a new market in Texas through the medium of the fair. This was done and sales of pure-bred live-stock were easily consummated.

The Fair Association had its financial difficulties and almost failed several times. In 1904 it was re-chartered under the name of the "State Fair of Texas." Since that time it has grown with much rapidity and today it is surpassed by none. Its present valuation is over $2,500,000, and the amount

of cash prizes for the various exhibits, chiefly live-stock and agricultural products, exceeds $100,000.

Since 1910 the fair has improved from year to year. The number of agricultural exhibits has increased and the live-stock displays include the best types of the principal breeds of beef cattle, dairy cattle, hogs, sheep, and chickens. The Fair Association sponsors the Boys' and Girls' Club Encampment which is under the direct supervision of the Extension Service of the Agricultural and Mechanical College. The Association provides housing accommodations and meals for about 500 farm boys and 300 farm girls each year, and in addition offers cash prizes for the best exhibits of their farm crops, live-stock, and sewing and canning work. It also provides three scholarships in the Agricultural and Mechanical College for the three highest records in farm crops and four scholarships for the girls making the highest records in their work to be used in the state college of their choice.

The influence of the State Fair of Texas has extended throughout the entire State. It has been a great stimulus to the organization of other state, district, and community fairs. There are today a total of five state fairs, ten district, seventy-five county and seventy-six community fairs held in Texas.

The four other state fairs include the Texas Cotton Palace Exposition, organized by the Chamber of Commerce of Waco in 1894; the San Antonio International Fair, established in 1899; the Southwestern

Exposition and the Fat Stock Show, held at Fort Worth and organized in 1887; and the Houston Fair and Exposition, which dates from 1920.

The Texas Cotton Palace was discontinued after a few years and was not reorganized until May, 1910. The first exhibition under the new organization was held from November 5 to 20 of that year. The old Cotton Palace Association gave large emphasis to exhibits of cotton production and manufacturing, but the new association has extended the displays to include live-stock exhibits, farm machinery, and other industrial products. The Texas Cotton Palace is now an established institution and is attracting both state and national attention. The plant includes thirty-two buildings, located in a beautiful park of forty acres.

The Southwestern Exposition and Fat Stock Show, as its name implies, restricts its exhibits to live-stock. It was first sponsored by the packing companies of Fort Worth. At first there were no premiums of any kind offered. The principal object of the Fat Stock Show was marketing live-stock. The fourth year J. J. Kimberlan, of Sherman, brought in the first herd of registered Shorthorns. Robert J. Kleberg, of the Kleberg Ranch, made a five-year contract with Kimberlan to purchase all of his bull calves for fifty dollars a head. This stimulated an increase in pure-bred beef cattle and caused many other breeders to bring their pure-bred herds to the show.

Previous to 1907 the Fat Stock Show was held

in tents and in the pens of the packing concerns of Fort Worth. No charges were made for entries or for admission. The expenses of the show increased to such an extent that a new organization was perfected and called the "National Feeders' and Breeders' Show." The present Colosseum was erected in 1907 at a cost of $280,000, principally from funds provided by the packing interests of Fort Worth. The first premiums offered at this show in early days consisted of hats, boots, spurs, saddles, and similar articles, donated by the commercial and business firms of that city. Since 1907 the Fat Stock Show has grown with much rapidity until today every class of registered live-stock is represented, together with all breeds of poultry and rabbits. Cash prizes and premiums are offered for all these exhibits. The Fat Stock Show is one of the most important agencies of the State in the promotion of better quality of live-stock.

The Houston Fair and Exposition was the last of the state fairs to be organized, but it has made rapid progress. The agricultural and live-stock exhibits have been excellent and the number has increased rapidly since the first fair was held. The Houston Fair and Exposition has the united support of the commercial interests of Houston and south Texas and is certain to exert an increasing influence in behalf of better farm products and live-stock.

An increasing number of county fairs are held each year throughout the State. These are fostered by the commercial interests of the town in which

they are held and emphasis is laid on the quality of the farm and live-stock exhibits. The premiums are sufficiently large and varied to attract the interest of agricultural producers. The county fairs have proved of great educational value.

The Agricultural and Mechanical College has been coöperating with the state, district and county fairs. A Director of Exhibits devotes his entire time to encouraging agricultural fairs and assisting in their organization. The institution also furnishes many judges for the live-stock and farm products. These persons also give judging demonstrations in all classes of live-stock, poultry, agricultural products, and home economics. The service of the College to agricultural fairs throughout the State is indicated:

Year	*Number of Fairs Assisted*	*Number of Judges Furnished*
1919	29	61
1920	65	119
1921	89	181
1922	126	226

A systematic effort is being made to have a fair held in each county where the agricultural and live-stock interests are sufficient to justify it. It is contemplated that these fairs will emphasize the importance of the products that are particularly well adapted to the county and section in which they are held. The educational and inspirational advantages of these fairs are fully appreciated by the people of the State and it is certain that the number of county fairs will be increased for the next few years.

CHAPTER XII

GOVERNMENTAL WORK FOR COUNTRY LIFE

Agriculture has been increasingly affected in recent years by governmental policies and regulatory laws. No two states of the Union have adopted the same policies in their effort to promote the progress of agricultural advancement, but practically every state has manifested increasing interest in agricultural welfare by passing laws relating to control measures for the protection of the farmer's interest, or legislation designed to encourage and assist him in various ways.

The farm population is not only directly affected by regulatory laws and governmental policies, but many general laws applying to the entire population reflect a helpful or harmful influence on the farmers. As farming has become a more exacting business enterprise, almost all laws affecting business in general are of concern to the farmer. It is increasingly important, therefore, for those interested in rural welfare to appraise the ultimate effects of those policies of the government reflected in statutes that relate to business activities and wealth production in the State.

POLITICAL SUBDIVISIONS OF TEXAS

For purposes of administration, Texas is composed of 253 counties, of which six are unorganized. The political subdivisions of the counties are called precincts. The number of precincts in each county varies from four to eight. Each precinct has its local officers. The administrative affairs of the county are delegated to a county judge, elected for two years from the county at large, and one commissioner, elected by the qualified voters of the precinct that he represents.

The county commissioners' court is charged with many policies affecting agriculture. The most important of these include laying out and establishment, change and discontinuance of public roads and highways, the building of bridges and the keeping of same in repair, and the exercise of general control and superintendence over all roads, highways, ferries and bridges in the county. The commissioners' court, on petition and vote of the qualified voters, may establish county libraries and levy a tax for their support. It is charged with the appointment of certain officers in the county, such as inspectors of sheep and road overseers, and, in case of vacancies, the commissioners' court, by majority vote, appoints the county treasurer, the county surveyor, the county hide inspector, the assessor of taxes, the collector of taxes, justice of the peace, and constable for the unexpired terms. The commissioners' court is authorized to establish and maintain an experi-

mental farm on petition of 10 per cent and a majority vote of the qualified voters of the county, the expenses to be borne out of general funds of the county. This court may also, under an act of the Thirty-fifth Legislature, appropriate not over $2,500 for farm demonstration work in the county, and, in coöperation with the Extension authorities of the Agricultural and Mechanical College, may appoint home and farm demonstration agents for the county. The commissioners' court has important functions connected with the raising of revenues, the borrowing of money and the control of county funds.

The principal defects of county government in Texas may be summarized as follows:

(1) County government in Texas suffers from too many restrictions by reason of the detailed provisions of the state constitution. The counties need larger freedom, both in organization and the exercise of powers of a local nature.

(2) There are too many elective offices in the county. Most of the duties of county officers are administrative and their selection should be based on particular qualifications for the work to be performed. The only way to select such men is by appointment, not by popular election. The inefficiency of county government in Texas is largely traceable to this defect.

(3) County government in Texas is partially supported by the fee system of paying public officers. A proposed constitutional amendment was submitted to the people by the Thirty-third Legislature, in 1913, abolishing the fee system in all state, district, county

PLATE X. Above, Hereford cattle on a west Texas range. Below, a flock of sheep on the Edward's Plateau.

and precinct offices, but it failed to receive a majority vote. However, it is only a matter of time until this very objectionable policy of paying county officers will be abolished.

As a means of increasing the efficiency of county government in Texas, Herman G. James advocates a commission form with a county manager, appointed by the commission, to administer the affairs.[1] He proposes an elective county commission of five to nine members chosen for overlapping terms. This governing body would be legislative and supervising purely, the administrative work being entirely intrusted to the county manager appointed by the commission on the basis of administrative experience and ability. This officer would be assisted by subordinates chosen by him on the basis of proved fitness for directing the work of the various departments. The plan of James deserves the most careful consideration of those interested in more efficient county government in Texas.

The next largest political unit in Texas is the representative and the senatorial district. There are 127 representative and thirty-one state senatorial districts. The Legislature is composed of one senator from each senatorial district and one or more representatives from each representative district, there being a maximum of 150 representatives which is the constitutional limit at the present time. The state

[1] See *County Government in Texas,* Bull. Univ. of Texas, No. 1732 (1917), p. 85.

of Texas is divided into eighteen congressional districts.

The political interests of the State have grown increasingly heterogeneous. The vast area, the variety of soils and climate, and the differences in wealth, population, and vocations in the several counties and sections cause the passage of many special laws. Increasing difficulty is experienced in drafting general laws that affect the entire population in the same way. This situation has made it increasingly difficult to secure the passage of constitutional legislation relating to taxation and education, regulatory laws affecting agriculture and conservation measures.

A NEW CONSTITUTION

The fundamental need of the State at the present time is a new constitution. The present one was adopted in 1876. Since it secured independence from Mexico, Texas has had five constitutions. That of 1836, which was the organic law during the period of the Republic, was superseded by another on the admission of Texas to statehood in 1845. Another constitution was adopted in 1866, which was quickly succeeded by still another in 1869. Several years later the present constitution was adopted and, with several amendments from time to time, has remained the organic law of the State until the present.

For forty years dissatisfaction has been expressed with the present constitution. This dissatisfaction has greatly increased in recent years. It is claimed

by many intelligent citizens that the present constitution is antiquated and a handicap to business enterprise. Governor Pat M. Neff strikingly contrasts present conditions with those at the time the constitution was adopted in the following words: "The men who wrote our constitution never rode across Texas in a Pullman car or studied beneath an electric light; they never talked over a telephone or listened to a phonograph; they never used a typewriter or had their bank account balanced with an adding machine; they never rode in an automobile, an electric street car, or dreamed of an interurban. They knew that man could not make a flying machine, and they would have been turned out of church for heresy had they believed in wireless messages or contended that ice could be made in August. We are living in another age. This is another generation, and Texas has a higher and broader vision than she could possibly have had a half century ago."

Agricultural problems are awaiting solution until the adoption of a new constitution. Educational policies of far-reaching consequence to rural schools as well as to institutions of higher learning are being delayed because they cannot be formulated and put into effect under the present provisions of the organic law. The inadequacy of the present constitution is indicated by the fact that each successive legislature submits numerous amendments to the people for consideration. In the past forty-five years more than one hundred amendments have been submitted and only thirty-eight have been approved. It has become

increasingly difficult to secure the approval of a really meritorious proposal because the people seem to believe that the defeat of all amendments will hasten the adoption of a new constitution.

The present constitution has prevented an equitable distribution of the tax burden of the State. Under existing laws an undue proportion of taxes seems to fall on the agricultural producer. The relief of this situation, partially at least, depends on revising the constitutional provisions relating to taxation and the rewriting of all existing statutory tax laws.

The property of the State rendered for taxes has increased from $2,755,171,793 in 1915 to $3,349,360,000 (approximately) in 1922. While there has been an average annual increase of $84,884,029 in the valuation rendered for taxes during the past seven years (1915-1922), there was a slight decrease in 1922. Although Texas has a full rendition law, it is a matter of general information that the rendition of property for taxation is much below the actual values. A comparison of valuations rendered for taxes with those reported to federal census-takers supplies a striking illustration of this situation. For example, the total value of farm property in Texas as reported in the last census was estimated at $4,447,420,321. The total tax rendition of the State in 1919, which is the comparable year, was $3,200,295,205. In other words, the farm values, as reported for census purposes, exceed the total rendition of the State for taxation by $1,247,225,116. The capital valuation of the agricultural, manufacturing, min-

ing, and industrial resources may be roughly estimated at $9,000,000,000. The renditions, therefore, are only approximately one-third of the actual value of all state property subject to taxation.

The constitution of Texas states that "taxation shall be equal and uniform," but under the existing administrative system, or lack of system, taxes are neither equal nor uniform. Each county commissioners' court in Texas determines the valuations of the county and the State has as many standards of valuation as there are counties. The effect of this situation is well illustrated by figures taken from the Tax Commissioner's report for 1922, as follows:

"Smith County, for the fiscal year ending August 31, 1922, paid net revenue into the State's treasury amounting to $94,920.34 and, during the same period received from the State $215,746.60; in other words, the county received from the State $120,826.26 more than it contributed.

"Lavaca County for the same period paid net revenue into the state treasury amounting to $129,934, and received in return $95,337; or in other terms, paid into the state treasury $34,591 more than it received.

"Smith County contains 602,753 acres assessed upon an average of $8.17 per acre. Lavaca County contains 610,484 acres assessed upon an average of $16.87 per acre.

"Floyd County contains 634,971 acres assessed at $13.00 per acre. El Paso County 657,605 acres assessed at $10.02 per acre. DeWitt County has 575,233 acres assessed at $19.56 per acre. Atascosa

County has 769,425 acres assessed at $10.18 per acre. Lubbock County has 568,815 acres assessed at $10.57 per acre. Even Cottle County, in the Panhandle section of the State, with a total acreage of 583,705, is assessed $8.31 per acre, while Fayette County with 396,502 acres is assessed at $16.84 per acre."

Smith, Lavaca and Floyd counties are rather typical agricultural counties in three characteristic sections of the State. It is not contended that land values are equal in these counties, or that all counties should bear an equal share of the tax burden regardless of area, capital, wealth, or resources. But it must be obvious that inequality will exist in the rendition of taxes if there is no state supervising agency with power to adjust tax renditions between counties.

There is need in Texas for a state equalization board with power to determine standards of values for assessing property, and to equalize taxes on the basis of these standards. A bill with this object in view was introduced in the Texas Legislature in 1923, but it failed of passage. It is certain, however, that an act creating this commission with power to supervise the administration of all tax laws will be passed at an early date, and Texas will be brought into line with well established policies that now prevail in most of the states. The farmers of Texas are especially interested in the equalization of taxes between agricultural resources and manufacturing and industrial enterprises. The opinion prevails throughout the State that real and personal property is bearing an

undue proportion of the tax burden. The Thirty-eighth Legislature in 1923 attempted to pass a law providing for a severance tax on oil, lumber, sulfur, and other natural resources, and to strengthen the laws relating to gross receipts tax, inheritance tax and taxes on pipe lines, as a means of equalizing the taxes on different classes of property and individual producers and, at the same time, providing additional revenues for the support of the state government. These efforts were only partially successful.

The prosperity of agriculture in Texas depends on a more equitable adjustment of taxes. In recent years many farmers have been unable to pay their taxes, due to financial conditions growing out of the World War. Thousands of farmers throughout the State have their names on the delinquent tax list. If prosperity is to return to the farmer, he must be given an opportunity to pay off his past obligations. One of the most effective ways of accomplishing this will be to equalize the tax obligations between agricultural producers and those of other business enterprises.

REGULATORY LAWS RELATING TO AGRICULTURE

The regulatory laws of Texas are administered by (1) the Commissioner of Agriculture, (2) the Board of Water Engineers, (3) the Reclamation Engineer, (4) the Live Stock Sanitary Commission, (5) the Commissioner of Markets and Warehouses, (6) the Director of the Experiment Station of the Agricul-

tural and Mechanical College, (7) the Game, Fish and Oyster Commissioner, and (8) the State Forester. The regulatory laws of the State relate to many aspects of agricultural endeavor and involve the expenditure of large sums of money annually.

The Commissioner of Agriculture is an elective officer in Texas. This office was created by the Thirtieth Legislature in 1907. This is the only elective officer who is charged with the administration of agricultural laws. The Commissioner of Agriculture serves for two years and his salary is fixed by law at $3,600 annually. He is charged with the administration of several control measures and the law specifically provides that it shall be his duty to encourage the proper development of agriculture. The various regulatory laws administered by the Commissioner of Agriculture were not all passed when the office was created. Laws relating to various control activities have been passed from time to time and the duties of enforcing them have been assigned to this official. At the present time the State Department of Agriculture consists of six major divisions, as follows: (1) a division of agricultural statistics, (2) a bureau of markets. (3) a division of edible nuts, (4) a division of entomology, (5) a division of plant pathology and seeds, and (6) a division of orchard and nursery inspection.

The fifteenth annual report (1922) of the Commissioner of Agriculture describes the duties of the several divisions in substance as follows:

The Division of Statistics is in charge of a chief

statistician whose duty it is to furnish current statistics of acreage and production of the various crops. This information is collected by correspondence from farmers and others interested in agriculture.

The Markets Division of the Department is in charge of a chief who is charged with the enforcement of the standardization law providing for uniform containers for fruits and vegetables and the packing, grading and inspection of these products for market.

The Division of Edible Nuts is in charge of an experienced man who devotes most of his time to the pecan industry.

The Division of Entomology is in charge of a chief who has devoted most of his time to the enforcement of the pink boll-worm law in this State. The Pink Boll-Worm Commission, with whom the entomologists in the Department coöperate, is charged with the responsibility of designating regulated zones and non-cotton zones where no infestation of the pink boll-worm exists. The chief of the Division has worked in close coöperation with the entomologists of the United States Department of Agriculture in the enforcement of state laws, and the results seem to indicate that the pink boll-worm has been completely eradicated from the State, or brought under such complete control that the threatened menace to the cotton industry appears to have been successfully combatted.

The Division of Plant Pathology and Seeds is in

charge of a chief. Its principal work, in coöperation with the Bureau of Plant Industry of the United States Department of Agriculture, has been the eradication of citrus canker. The Plant Pathologist of the Department of Agriculture administers the citrus canker law passed by the Thirty-seventh Legislature. The citrus-fruit territory is divided into five districts and systematic inspections of citrus trees have been made and all infected specimens have been destroyed. Other plant diseases, especially those of pecans, have received attention of this department. This Division also administers the Texas Seed Law, passed by the Thirty-sixth Legislature. The Department maintains a laboratory for testing germination quality of seed. An effort is being made to protect the farmers from weedy seed. The law should be amended and increased facilities for seed inspection and larger police powers should be given in the enforcement of regulations as a means of safeguarding farmers from unscrupulous seed-dealers and misrepresentations concerning the quality.

The Division of Orchard and Nursery Inspection is in charge of a chief who is assisted by six inspectors. The duty is to inspect the nursery and floral stock of the State. The report of the Commissioner of Agriculture shows that this Division has examined and inspected more than 2,000 premises and 15,205,665 plants, destroyed 28,981 diseased trees and plants, and treated approximately 55,973 plants that could be saved, during the year 1921.

The State provided $162,000 for the Department

of Agriculture for the year ending August 31, 1921, and $82,722 for the year ending August 31, 1922.

The Board of Water Engineers was created by an act of the Thirty-third Legislature in 1913, for the purpose of administering the irrigation laws of the State. It is composed of three members appointed by the Governor, by and with the advice and consent of the Senate. The term of office is for six years, but the terms overlap so that only one new commissioner is appointed every two years. The act provides that the unappropriated waters are State property, including "flow and underflow and tides of every flowing river or natural stream, of all lakes, bays or areas of the Gulf of Mexico, collection of still water and of storm, flood or rainwater of every river, or natural stream, canyon, ravine, depression or watershed, within the state of Texas, the title of which has not already passed from the state." [1]

The Board of Water Engineers is given complete control over the diverting of these waters to private uses. The purposes for which these waters may be diverted are specifically restricted by law to "irrigation, mining, milling, manufacturing, development of power, the construction and operation of water works for cities and towns, or for stock raising." The Board is charged with the duty of stream measurement and flow of streams, the collection of data and surveys of available water resources for irrigation and other purposes, the determination and

[1] Section 1 of Chapter 171 of the Acts of the Thirty-third Legislature in its regular session.

location of land best suited for irrigation, the determination of the best location of reservoir sites and the estimated cost of irrigation projects.

This Board has contributed greatly to irrigation, reclamation and the conservation of the water resource of the State. The Legislature appropriated $42,900 for each year of the biennium of 1921-1923 for this Board.

The office of Reclamation Engineer was created by the Thirty-third Legislature in 1913 in an act amending the Levee and Drainage Act, passed by the Thirty-second Legislature in 1911. The amended act abolished the State Levee and Drainage Board and the office of State Levee and Drainage Commissioner and substituted the office of Reclamation Engineer. This officer is appointed by the Governor, by and with the advice and consent of the Senate, and serves for two years or until his successor is appointed and qualified.

The primary object of the amended levee and drainage act is declared to be to "devise and plan and mark out upon the ground all the improvements necessary to reclaim or cause to become suitable for agricultural uses, the overflowed and swamp lands, and overflowed areas in the coastal plain," and elsewhere in the State where temporary or permanent excessive accumulations of water on the land prevent its profitable use for agricultural purposes.[1]

The Reclamation Engineer is charged with the duty

[1] Section 2, Chapter 145 of the Acts of the Thirty-third Legislature.

of making topographic and hydrographic surveys in connection with designing and planning the most practical, permanent, economic, and feasible systems of leeves, dikes, drains, canals, dams, and waterways in connection with proposed reclamation or drainage areas. He is given broad supervisory powers in connection with drainage and leveeing improvements. The Legislature appropriated $52,150 for each year of the biennial period from 1921-1923 for this department.

This officer has been an important factor in the reclamation work of the State and his opportunities in coöperation with the Board of Water Engineers have been increased greatly by the appropriation of $600,000 by the Thirty-eighth Legislature (1923) for the purpose of making a comprehensive topographic and hydrographic survey of the principal river valleys of the State as a basis for the establishment of improvement districts for flood prevention, irrigation, and land reclamation. This program contemplates the irrigation of about 12,000,000,000 acres of land that is now too dry for profitable production and the reclamation of about 4,000,000 acres that overflow or that are too wet for profitable cultivation.

The importance of the live-stock industry in Texas and the great losses that it sustained as a result of infectious, contagious, or communicable diseases made it necessary in the interest of public welfare to provide by legislative action for their protection, as far as possible. Stock-raisers sustained great

losses from Texas fever in the southern sections before the cause of the disease became known. From time to time epidemics of the foot-and-mouth disease resulted in a peril to the State and considerable loss to individual cattle producers. This situation resulted in the creation of the Live Stock Sanitary Commission by an act of the Twenty-third Legislature in 1893. The Commission at the present time consists of three members appointed by the Governor, with the advice and consent of the Senate. The law prescribes that each member of the Commission shall be a practical live-stock raiser with at least five years' experience.

The duties and powers of the Commission have been modified or extended by the Legislature from time to time. At present they may be summarized as follows: (1) the Commission is authorized to establish, maintain, and enforce quarantine lines and sanitary rules and regulations with reference to the protection and shipment of live-stock; (2) to cooperate with the Federal Government and officers of other States in the protection of live-stock (3) to assist in the eradication of live-stock diseases, including Texas or tick fever, the scabies, anthrax, tuberculosis, hog cholera, and glanders.[1] The live-stock sanitary laws were amended in 1915 by making it the duty of the Commission to aid in the eradication of scabies in sheep by quarantining against the bringing of infected sheep into the State;

[1] Section 3, Chapter 169 of the Acts of the Regular Session of the Thirty-third Legislature.

(4) the Commission is empowered to appoint a State Veterinarian, assistant veterinarians, and inspectors for enforcing the provisions of the laws.

The Live Stock Sanitary Commission has extensive powers and important responsibilities. The organization consists of approximately one hundred employees. The Legislature appropriated $271,050 for each year of the biennial period of 1921-1923 for the salaries, traveling expenses, and maintenance of the organization.

The annual report for 1921 of the Live Stock Sanitary Commission reviews the scope of activities and the policies adopted of administering the laws for the protection of live-stock. For the eradication of the fever tick (*Margaropus annulatus*) the State is divided into three zones: the northern zone, or Zone 1, comprising some forty-seven counties and parts of six others; the middle zone, or Zone 2, comprising thirty counties; and the southern zone, or Zone 3, consisting of forty-nine counties and part of four others. The tick-infested area may be described as comprising that south of a zigzag line extending from the Texas-Oklahoma boundary between Collingsworth and Childress counties to the Texas-Mexican boundary between Brewster and Terrell counties. North and west of this line there are no fever-ticks and the infested area is greatest in Zone 3 in the southern part of the State. The policy of the Commission has been to eradicate the fever-tick first in Zone 1 where the infestation is least serious, and as rapidly as possible to destroy

it in county after county until the entire State is free.

The work of tick eradication has not always been popular. In some sections of the different counties the feeling has been so strong that vats have been dynamited to stop the dipping of cattle. In some cases the Live Stock Sanitary Commission has had to call on the Adjutant General to send rangers during the dipping season to protect the dipping-vats and to assist in carrying out the law. However, gradually opposition to the law is disappearing and increasing coöperation in its administration is being secured. The extent of the work is indicated by the fact that 15,367,280 cattle were dipped and inspected for fever-tick infection in 1920.

The Live Stock Sanitary Commission dipped and inspected for scabies 1,432,931 sheep in 1921. Of this number 317,464 were found to be infected and 132,263 were classed as exposed. Sheep scabies eradication was carried on in seventy counties in different parts of the State in 1920. The area of greatest infection is in southwest Texas where the sheep industry is most extensive. Important results have been obtained in tuberculosis eradication in dairy herds. The accredited herd plan has been adopted and the Live Stock Sanitary Commission has cooperated with the federal authorities in the inspection of dairy herds. During the year 384 pure-bred, or pure-bred and grade herds, consisting of 22,269 cattle, were given either the initial or second test for tuberculosis. Of this number, 709 reacted to the

test and were condemned and 113 were classed as "suspects."

The Commission reported progress in the eradication of glanders, anthrax (charbon), hemorrhagic septicemia, and hog cholera.

The fertilizer law, the foul brood law, and the feed control law are administered by officials of the Agricultural and Mechanical College.

The present act regulating the sale of commercial fertilizers supersedes a law passed by the Legislature in 1899, and has been in force since September 1, 1911. It regulates the sale of commercial fertilizers, prohibits the adulteration or misbranding of this product, and provides for the collection and analyses of samples of fertilizers offered for sale. The chemist of the Texas Agricultural Experiment Station of the College, who by this act is designated the State Chemist, is charged with administration of the fertilizer law and is given certain police powers.

The present foul brood law was passed by the Thirty-third Legislature in 1913 and supersedes and extends the scope of the provisions of Chapter 126 of the Acts of the Regular Session of the Twenty-eighth Legislature passed in 1903. The law provides for the suppression and eradication of foul brood and contagious diseases in bees by regulating the sale and shipment of honey-bees, the quarantine of infected insects and the inspections necessary to determine the condition of apiaries. The chief of the Division of Entomology of the Agricultural Experiment Station of the College is designated in this act the State

Entomologist and is charged with the administration of the foul brood law. This officer is made responsible for the formulation of rules and regulations for carrying out the provisions of the law, and the necessary police functions are delegated to him in connection with the enforcement of the law and the regulations formulated under its provisions.

The first law regulating the sale of "concentrated commercial feed stuffs" was passed in 1905 and has been subsequently amended several times for the purpose of extending its provisions and making it more specific. The law regulates the sale of grains and cottonseed products sold for feed by requiring that they shall bear a tag showing the quantity, name. and contents of each container, and the name and address of the manufacturer. The feed control law is administered by the Director of the Agricultural Experiment Station of the College who is given authority to adopt regulations, set up standards, and make analyses of commercial feed stuffs offered for sale. This officer is also charged with the duties of making the necessary inspections of commercial feed stuffs, insuring compliance with the law, and enforceing conformity with the provisions of the statute when it is found that any of its provisions are being violated.

The original warehouse and marketing law was passed by the second called session of the Thirty-third Legislature in 1914. The statute creating this department was the direct result of the influences of the European War, that had just begun, on the

price of cotton and other farm products. The decrease in consumption of American cotton by European mills made it highly desirable to provide additional warehousing facilities for the cotton of Texas during the war period. It was hoped that by the passage of this act the producers would not suffer any serious losses, and that provision could be made for storing cotton and supplying it to the markets in quantities that the cotton milling industry could consume on the basis of the reduction in number of available spindles, both in this country and in Europe.

The purpose of the orginal act was set forth in the first section which declared it to be the purpose of the law "to provide a system of state bonded warehouses and to afford a method of coöperative marketing for those engaged in the production of farm and ranch products." The act provided for a Board of Supervisors of Warehouses, consisting of the Governor of the State, the Commissioner of Agriculture, and the Commissioner of Insurance and Banking, to administer the provisions of the law.

The original act was amended at the first called session of the Thirty-fifth Legislature in 1917 by creating the office of Commissioner of Markets and Warehouses to administer the act, instead of the Board of Supervisors of Warehouses. The appointment of this officer was delegated to the officials constituting the original Board of Supervisors of Warehouses.

The Commissioner of Markets and Warehouses is

given important supervisory powers over gin operators of the State by requiring that each ginner obtain a license and a bond. The ginner is required by law to guarantee the correctness of the sample of cotton ginned and to comply with definite standards with reference to wrapping the bale and the quality of bagging that is used. This officer is also charged with the establishment of standards of classification of cotton, corn, and other farm and ranch products, and is responsible for the enforcement of these standards throughout the State. He also regulates public weighers and grants charters for coöperative agricultural, horticultural, and stock-raising associations. Bonded warehouses are provided for in this act and their supervision and control are placed under the Commissioner of Markets and Warehouses. The act provides for the appointment by this officer of a board of examiners for cotton graders and classers. Public cotton classers must secure a license from this board through the Commissioner. A bond is required of all persons who operate under a license acquired through the Commissioner of Markets and Warehouses.

The annual report for 1922 of the Markets and Warehouse Department gives a detailed account of the administration of this act. In substance, the report states that the work of the Department is organized in the following divisions: (1) a division of weights and measures, (2) a division of warehouses, (3) a division of markets, (4) a division of cotton gins. In addition to these four divisions

or branches of the Department, there are two boards created by and under the supervision of the Department—the cotton classing and the grain classing boards. The Department established standards for sorghum grains and ribbon cane sirup during the year 1922. It has established a radio market news service for broadcasting agricultural market reports, and has collected important data relating to cotton mills and other agricultural manufacturing processes. The cotton gin division reports 3,521 licensed gins during the year ending August 31, 1922. There was only one complaint filed and one conviction for violating the gin regulations during that year. The warehouse division reports a reduction in insurance rates of bonded warehouses, the valorizing of state bonded warehouse receipts and the securing of financial assistance from the War Finance Corporation for state bonded warehouses. The division of markets reports additional grading and standardization work of farm products in coöperation with the Agricultural and Mechanical College in the testing of grain grades. There are thirty-one employees in this department. There was a total expenditure for all purposes of $80,583.83 per annum.

The laws of the State relating to the conservation and propagation of game, fish, and oysters are of interest and concern to farmers and stock-raisers. These have a more or less direct bearing on the problem of the food supply. The farmers are also directly interested in the conservation of bird life, for a number of species of birds feed on insect pests that

are harmful to economic plants. Farmers are also interested in the destruction of rodents and predatory animals that destroy crops and live-stock. The Legislature has provided bounties from time to time for the destruction of rodents and wolves or other animals that kill young calves and lambs.

The earliest legislation relating to game, fish, and oyster conservation was in the form of local laws. For example, the Legislature has passed a number of statutes making it unlawful to kill wild turkeys or squirrels in certain counties during part of the year, or to trap foxes, minks, or raccoons, or to fish with nets. While some of these special county laws still exist, most of them have been superseded by two comprehensive statutes, one relating to game and the other to fish and oysters. These laws are administered by the Game, Fish and Oyster Commissioner, who is appointed by the Governor and serves for two years. The office of Game, Fish and Oyster Commissioner is maintained by a tax derived from the sale of fish and oysters, the sale of certain products such as sea shells, and a hunting license that is required of all hunters who shoot game outside of their own counties, or who come into the State for the purpose of hunting.

The laws prescribe the conditions under which fish and oysters can be sold. Those who wish to engage in the culture of oysters must make application and secure a formal permit from the Commissioner. The law forbids the catching of oysters during certain months of the year and a penalty is inflicted for

its violation. Seining for fish is also prohibited during certain periods. Where and when seining is permitted and the kind of nets that can be used are carefully prescribed.

The game laws carefully define the open season for hunting and provide a penalty for the violation of this provision during the closed season. The number of certain kinds of game, such as deer, that any one person can kill in a season is limited. Hunting deer at night by lamps or lanterns is forbidden. The game, fish, and oyster laws are enforced by deputy inspectors appointed by the Commissioner.

The sum of $63,940 was expended in the administration of the game, fish and oyster laws for the year ending August 31, 1922, and the sum of $61,440 for the year ending August 31, 1923.

In view of the extent of the forest resources of Texas, it is surprising that the State has been so slow in the formulation of a constructive forestry policy. There was no legislation relating to forestry previous to 1915. The Thirty-fourth Legislature in that year created the office of State Forester and provided that the Board of Directors of the Agricultural and Mechanical College should be responsible for his appointment. Under the provisions of this act the State Forester, in addition to administering the forestry laws, is made Professor of Forestry and Forester to the Agricultural Experiment Station in the Agricultural and Mechanical College.

The administrative duties of the State Forester consist of extinguishing forest fires, enforcing the

laws pertaining to the protection of forests and woodlands, and instituting legal proceedings against those who violate these laws. He is also charged with the duty of collecting data relative to forest conditions and of coöperating with the land owners for the protection, management, and replacement of trees, woodlots, and timber lands.

The act gives the Governor power to accept gifts of land to be used to demonstrate the practical utility of timber culture and water conservation. It is also contemplated that these lands are to be used as game preserves. This power has not been exercised, as no land has been donated for this purpose.

The appropriations for the Department of Forestry have been too inadequate to make the largest results possible, the first being $10,000, which was later increased to $12,000. The Thirty-seventh Legislature (1921) increased the appropriation to $20,750 per annum. These sums have been very inadequate, but much has been accomplished during the short period that the law has been in existence. The Texas Forestry Association has rendered a great service to the State Forester in creating favorable sentiment and in the dissemination of important information relating to forestry problems. This Association was responsible for the introduction in the Thirty-seventh Legislature of a bill providing for the purchase of a large tract of the cut-over lands in east Texas to be utilized for reforestation purposes. It was proposed to provide funds for this purpose through a severance or production tax on lumber,

amounting to twelve and a half cents a thousand feet. The bill failed of passage, but favorable committee reports from both the House and the Senate were obtained. A similar bill, but with the severance tax provision omitted, was introduced in the Senate of the Thirty-eighth Legislature. It is certain that within a reasonable time the Legislature will pass a law providing for a constructive forestry policy involving the reforestation of vast areas of cut-over lands in east Texas, adequate fire protection for existing virgin timbers and reforestation in the devastated areas of the Edwards Plateau, the mesquite belt of south Texas, and the treeless areas of west Texas.

Agricultural legislation in Texas has not been guided by any definite policy. Laws have been passed from time to time as problems have arisen without regard to previous acts, or to future legislative policy. The result has been that there have been conflict of functions and duplication of effort. There is great need in Texas at the present time for a thorough revision of all laws relating to agriculture, with the view to the coördination and articulation of all existing educational and regulatory activities in this field.

One of two alternatives probably should be followed in the formulation of an agricultural code for the purpose of harmonizing existing agencies. (1) The first of these proposals involves the complete separation of the regulatory or police functions from the educational activities relating to agriculture.

This policy would result in the complete separation of all regulatory activities from the work of the Agricultural and Mechanical College. At the present time the College is administering the fertilizer, the foul brood and the feed control law. These regulatory functions would be transferred from the College. On the other hand, the Department of Agriculture, located at Austin, is doing some educational work and maintaining several laboratories that would properly be transferred to the College if this plan were adopted. (2) The other alternative would be to transfer the administration of the regulatory and police functions to the College and create a fourth division coördinate with resident teaching, agricultural extension, and agricultural research, to be known as the Regulatory Division. This division would be administered by a director who would be appointed by the governing board of the College and charged with the administration of all police functions relating to agriculture. This officer would rely for his information on the research division of the College. Those who advocate this solution of the problem believe that by this means it would be possible to coördinate the scientific background of the regulatory activities and, at the same time, secure complete harmony between all the agencies serving the needs of agriculture and insure economy in the expenditure of public funds.

A modification or a compromise between these extreme policies has been under consideration by thoughtful citizens. This compromise provides for

of interests between the several officials administering regulatory laws.

It is highly important for the State to adopt a definite agricultural policy and conform its laws to it as a means of coördinating and systematizing all the statutes that have been passed in the interest of rural welfare. An Agricultural Commission composed of all the agricultural and live-stock interests of the State should be appointed by the Legislature to formulate such a policy. It is not likely that much progress will be made in formulating a constructive and coördinated program until this is done.

CHAPTER XIII

RURAL EDUCATIONAL ENTERPRISES IN TEXAS

Social institutions promoting country life welfare in Texas consist of the rural school, rural activities of the institutions of higher learning, the rural church, rural Y.M.C.A. activities, rural libraries, the agricultural and country press, and county Red Cross work. Some of these institutions were created by the State and depend on it for maintenance and support. Others have been fostered by private social agencies and depend for support and direction on those responsible for their existence. All of these agencies are promoting some aspects of rural life. The following discussion is an effort to summarize those activities of the above named social institutions that are directly related to rural welfare.

THE RURAL SCHOOL

The declaration of Texas' independence adopted on March 2, 1836, gave as one of the reasons for severing the connection between Texas and the Mexican nation that "it has failed to establish any public system of education, although possessed of almost boundless resources." This document is the only one

of its kind that ever gave this as a reason for revolution. The vast public domain constituted the "boundless resources" referred to in this declaration. It was but natural, when Texas had acquired her independence, that the people should turn to the public lands as the chief source of general revenues, especially for the public school system.

In 1838, soon after the Republic of Texas was established, President Houston made the following significant recommendation for the creation of a permanent endowment for public school purposes by the reservation of public lands:[1]

"The present is a propitious moment to lay the foundation of a great moral and intellectual edifice which will in after ages be hailed as the chief ornament and blessing of Texas. A suitable appropriation of lands to the purpose of general education can be made at this time without inconvenience to the government or the people; but defer it until the public domain shall have passed from our hands, and the uneducated youths of Texas will constitute the living monuments of our neglect and remissness. A liberal endowment which will be adequate to the general diffusion of a good rudimentary education in every district of the Republic and to the establishment of a university where the highest branches of science may be taught can now be effected without the expenditure of a single dollar. Postpone it a few years, and millions will be necessary to accomplish the great design."

[1] Quoted in Dudley G. Wooten's *A Comprehensive History of Texas* (1898), Volume 2, p. 428.

The policy recommended by President Houston seems to have been accepted readily, for on January 26, 1839, an act was passed which set apart three leagues, consisting of 4,428 acres each, in each county, for the purpose of establishing and maintaining a primary school.[1] This act also directed the President of the Republic to have fifty leagues surveyed from any part of the vacant domain for the endowment of two universities or colleges to be created at a later date. The constitution of 1845 contained a provision that enabled the counties that did not contain as much as four leagues of public lands to secure a sufficient number of acres of the public domain elsewhere to make up the total amount. It also forbade the sale of the land for twenty years. The constitution of 1861 repeated this provision.

In 1875 an act of the Legislature was passed appropriating four leagues to organized counties that had not previously received a grant of land for school purposes.[2] "The evident intention of the Legislature," says McKitrick, "was to provide each county, whether organized or not, with four leagues of school land; it appears, however, that only 239 counties have received such land."[3]

The constitution of 1876, which is the one now in force, extended the policy of appropriating public lands to counties for school purposes by reserving

[1] Sayles *Early Laws of Texas*, Volume 1, p. 319.
[2] Sayles' *Op. cit.*, Volume 3, p. 325.
[3] *The Public Land System of Texas*, Bull. No. 905, Economics and Political Science Series of the Univ. of Wis., Chap. 5, p. 92.

public lands as a perpetual endowment for the schools of the State. The source of these lands included "all the alternate sections of land reserved by the state out of grants heretofore made, or that hereafter may be made to railroads or other corporations of any nature whatsoever; one-half of the public domain of the state; and all sums of money that may come to the state from the sale of any portion of the same." [1]

The effect of all these laws has been the appropriation of more than 49,000,000 acres to the permanent school fund, distributed as follows: approximately 45,000,000 acres granted to the State public school fund and 4,229,166 acres to counties for public school purposes. In addition to this, 2,289,225 acres have been granted for the endowment of the University and its branches. This endowment is nearly seven times as large as that ever received by any other state. The school fund is now estimated at $73,892,959.93. This does not include the value of nearly 4,000,000 acres of unsold land, for which a rental of three to eight cents an acre is being received. This endowment is derived from the sale of the public school lands. These funds have been invested in school district, county, state, and railroad bonds, and land notes. The report of the Land Commissioner under date of August 31, 1920, states that $46,915,674.20 was invested in land notes, and $24,760,210.84 in bonds, and that there were $217,-

[1] Article 7, Section 2, *Constitution of Texas.*

074.89 on hand at that date. The county permanent school fund, including the value of unsold lands, totals $12,751,493. Of this sum, $5,097,900.30 is invested in bonds and $4,519,949.69 in vendor's lien notes, and the balance in other securities and cash.

The total value of school property, as reported by the State Department of Education in 1921, is as follows:

	White	*Colored*	*Total*
Common school districts	$20,324,445	$1,239.720	$21,564,170
Independent districts...	48,661,614	2,598,910	51,260,524

The State's expenditures for public school purposes in 1919-1920 amounted to $30,659,574.93. Of this, $25,185,550.31 was for maintenance and $5,474,024.62 for building and sinking funds. The sources of the available school fund in Texas during 1917, 1918 and 1919 were as follows: (1) the income from the permanent school fund, which amounted to approximately $3,000,000 per annum; (2) one dollar of every state poll tax; (3) one fourth of all the occupation taxes; (4) the proceeds of the thirty-five cent ad valorem tax, which is levied for the support of the schools and for the purchase of free text-books.

The State's per capita has increased from $7.50 in 1918-19 to $14.50 in 1920-21. An increase in the per capita in 1918-19 was made possible by special appropriations to all the rural schools, amounting to $1,000,000. It was possible to increase the per capita to $8.50 in 1919-20 as a result of the tax placed on oil. The great increase in per capita in 1920-21

was the result of an appropriation of $4,000,000 from the general revenues of the State for the purpose of increasing the salaries of teachers.

The Legislature appropriated $2,000,000 a year in 1919-20 and 1920-21 for special aid to rural schools. This fund was reduced to $1,500,000 in 1921-1922. The rural schools are the weakest part of the public school system in Texas and these special appropriations have been made for the purpose of increasing rural educational facilities. These funds have been instrumental in replacing poor and inadequate buildings with modern sanitary schoolhouses in many communities. Good equipment and better library facilities have also been provided, and better qualified teachers have been secured. The length of the term in the rural schools has been increased to approximately seven months.

The enrollment of pupils in the public schools of Texas in 1920-21 is as follows:

	White		
	Elementary Schools	*High-Schools*	*Total*
Independent districts	395,334	86,406	481,740
Common school districts..	409,109	31,841	440,950
Total	804,443	118,247	922,690
	Colored		
	Elementary Schools	*High-Schools*	*Total*
Independent districts	82,266	5,649	87,915
Common school districts..	102,323	1,034	103,357
Total	184,589	6,683	191,272

Total for the State

Independent districts	569,655
Common school districts	544,307
Total	**1,113,962**

The scholastic enumeration of the State for 1920-21 was 1,271,157. It will be observed that a large number of children in Texas are not enrolled in the public schools. This is partially explained by the fact that many children attend parochial schools. However, it is evident that many children are not attending any school. The State has a compulsory attendance law on its statute books, but its provisions are being indifferently enforced in many places.

Texas employed 27,479 teachers in the public schools in 1920-21. Of this number 12,672 were teaching in independent districts and 14,711 in common school districts. There were 11,362 white teachers in independent districts and 12,408 in common school districts. There were 1,490 colored teachers in independent districts and 2,229 in common school districts. The average salary paid teachers in independent districts was $1,021.76, and that in common school districts $699.48.

The preparation of Texas teachers is indicated by the fact that 34 per cent hold second grade certificates and 36 per cent first grade, while only 7 per cent have permanent primary certificates and 23 per cent permanent certificates. Twelve per cent of Texas teachers are college or university graduates, 22

per cent normal school and 39 per cent high-school graduates.

A comparison of rural and urban school conditions indicates that the former is uniformly less favorable than the latter. For example, in 1918-19 there were 100,000 more children enrolled in common school than in independent districts, but the number of pupils in high-schools in independent districts was more than double that enrolled in high-schools in common school districts.

The statistics relating to illiteracy show the same unfavorable tendency. The total number of illiterates in Texas over ten years of age in 1920 was 295,844. The urban illiterates were reported at 80,333, while the number of rural illiterates was estimated at 215,511. Two elements in the Texas population largely account for the great number of illiterates. The Mexican and negro populations contain very high percentages. The foreign born white illiterates numbered 112,417, most of which were Mexicans, and the negroes 122,838.

There has, however, been great improvement in the rural schools of the State in recent years. The number of consolidated schools increased from 491 in 1918-19 to 757 in 1921-22, an increase of 54 per cent. The number of one-teacher schools decreased from 6,173 in 1918-19 to 4,233 in 1921-22, a decrease of 31 per cent. The number of teacherages, most of which are located in rural communities, advanced from 486 in 1918-19 to 635 in 1921-22, an increase of 30 per cent. During the four years following

1918-19, 1,650 rural school houses were built in Texas.

AGRICULTURAL EDUCATION IN THE PUBLIC SCHOOLS

Efforts to promote agricultural education have passed through four stages in Texas. The first is represented by the passage of a law by the Twenty-ninth Legislature requiring elementary agriculture and cotton grading to be taught in the public schools. This, followed by the passage of a law stipulating that agriculture be taught along with manual-training and domestic economy as a vocational subject in the high-schools outside of incorporated towns and cities, brought to the front the problem of teachers adequately prepared to present the subject to pupils in the schools. To meet this situation the Legislature enacted a law requiring agriculture to be taught in all teacher training institutions. Finally, Texas accepted the provisions of the Smith-Hughes Act and entered on a policy of vocational training in agriculture in the rural schools. The Legislature has passed several statutes designed to promote teacher training in agriculture. The rapid increase in the number of schools offering courses in elementary or vocational agriculture has created an unusual demand for better trained teachers of this subject. Laws have been passed requiring agriculture to be taught in the normal colleges of the State, the College of Industrial Arts, the state school for women, the Agricultural and Mechanical College of Texas and the University

of Texas. Agriculture is also included in the list of subjects required for a State certificate. A text on agriculture is included in the list of books required to be taught in the public schools. Cotton classing must also be taught in the public schools under certain conditions and the Thirty-third Legislature passed a law requiring "cotton classing to be taught in all the state normal schools, industrial schools, summer normal schools, teachers institutes and in all public schools," although it is not required in independent districts of more than 300 scholastics, or where the "cotton acreage is less than ten per cent of the total acreage planted to farm crops."

THE AGRICULTURAL AND MECHANICAL COLLEGE

The Agricultural and Mechanical College of Texas and its branches are directly responsible for agricultural research and education, both of resident students and non-resident men and women. This group of institutions consists of the main college at College Station, in Brazos County, two coeducational junior colleges, known as the John Tarleton Agricultural College at Stephenville, in Erath County, and the North Texas Junior Agricultural College at Arlington, in Tarrant County. The Prairie View State Normal and Industrial College for Negroes, located at Prairie View, in Waller County, is the negro land-grant college of the State and a branch of the Agricultural and Mechanical College.

The Agricultural and Mechanical College of Texas

was established in 1876. Like similar institutions in other states, it had its origin in the first Morrill Act, passed by Congress in 1862, which set apart public lands to the several states and territories for the establishment of a college for the teaching of agriculture and the mechanic arts.

The organization of the College consists of three divisions, as follows: (1) resident instruction, (2) agricultural research, and (3) agricultural extension. These three divisions are coördinate. The agricultural curricula of the College have been an evolution. In the early years of the institution the subject matter of agriculture was very limited. There was also great prejudice against the study of the subject and few students could be induced to take courses in agricultural education. There has been a remarkable growth in the content of agricultural subject matter in recent years. Agricultural research has greatly enriched the curricula. An interesting differentiation in courses has resulted. At the present time the Agricultural and Mechanical College offers four-year courses in agriculture, agricultural administration (the business aspects of agriculture) and agricultural education for the training of teachers, and two-year courses in general agriculture and agricultural engineering. The School of Agriculture now includes ten departments, as follows: agricultural education, agricultural engineering, agronomy, animal husbandry, dairy husbandry, entomology, horticulture, poultry husbandry, rural economics and rural sociology. Eight hundred and

fifty-two students pursued courses in agriculture in the College in the year 1922-23.

The Texas Experiment Station is the designation given to the agricultural research division of the College. At present it consists of a main station at College Station and thirteen branch stations, located at Beeville, Troup, Angleton, Beaumont, Temple, Denton, Spur, Lubbock, Balmorhea, Chillicothe, Sonora, Pecos, and Nacogdoches. In 1923 the Legislature established a citrus-fruit station to be located in the lower Rio Grande Valley. The research division of the main station includes veterinary science, chemistry, horticulture, animal husbandry, entomology, agronomy, plant pathology and physiology, cotton breeding, farm and ranch economics and soil investigations. More than sixty projects are under investigation at the main station. The branch stations are in typical areas of the State and consist of field laboratories where important investigations and tests are being made with reference to field crop, horticultural, and animal husbandry problems.

Extension work had its origin in efforts to control the Mexican boll-weevil. In 1903 the United States Secretary of Agriculture requested Seaman A. Knapp to make a demonstration in Texas of the efficiency of better cultural practices in the control of the boll-weevil. The first demonstration was conducted on the farm of Walter G. Porter, at Terrell, Texas, and consisted of a seventy-acre plat of land on which the soil was prepared and the crop planted and cultivated under supervision of the United

PLATE XI. The famous "Turkey Trot" at Cuero.

States Department of Agriculture. It was necessary for the business men of Terrell to raise the sum of $1,000 to indemnify the demonstrator in case the experiment should not prove successful and he should thereby sustain a loss by having followed the directions of the Department. However, it was found when the demonstration was completed that Porter had cleared $700 more than he would have under ordinary methods of cultivation. This demonstration attracted wide attention and was given extensive publicity through the press. This effort marked the beginning of the demonstrational method of teaching farmers better agricultural practices, and the Secretary of Agriculture, encouraged by results of this experiment, set aside $40,000 out of congressional appropriations for further demonstrations.

The first county agent appointed in Texas was W. C. Stallings who was stationed in Smith County in 1906. Because of the scarcity of funds and the uncertainty of the effectiveness of county agent work, only a few additional agents were employed until 1908. From 1908 to the passage of the Smith-Lever Act in 1914 county agents were appointed in the counties just as rapidly as funds for the purpose would permit. The Department insisted that primary emphasis should be laid on the control of the boll-weevil, yet agents were permitted to conduct demonstrations in the production of practically all staple field crops. The wisdom of the comparatively restricted scope of extension work in the early days has been clearly demonstrated by the measure of

public confidence it attained in spite of opposition, and by the rapid development of agricultural extension work since the passage of the Smith-Lever Act. There are few communities, not only in Texas but in the whole nation, in which the work of county and home demonstration agents is not looked on as being of great benefit to the people. The aims of farm and home demonstration work as set out by its originator were as follows: (1) to reform agriculture and make it an occupation of profit and pleasure, (2) to improve rural conditions, (3) to broaden and enrich rural life, (4) to make the farm attractive and country residence desirable. In order to carry out these aims, extension work of the State is conducted under four general heads: (1) Farm demonstration, (2) boys clubs, (3) girls clubs; and (4) home demonstration.

Demonstrations with adult farmers deal with problems of soil conservation, soil management, economical crop production, and economical distribution and marketing of farm products. Each project is intended to demonstrate a definite principle, such as soil conservation, the improvement of the varieties of field crops, the advantages of the application of better cultural practices, and the methods of marketing the products that may be grown. Agricultural practices of the farmers of the whole country have been greatly improved by the work of these demonstrations. The following illustration will bear out this statement. In the black land cotton-belt, which was once noted for the superior quality of staple

grown, the cotton had deteriorated to the extent that the section had lost its former standing. In 1916 the Extension Service launched an educational program looking to the improvement of the quality of the staple grown, and as a consequence, in 1921 75 per cent of ten thousand samples of cotton grown by farmers in that section showed a substantial improvement in length of staple.

In 1908 the first boys' agricultural clubs were organized, but it was not until 1914 that special emphasis was placed on this activity. In each county where an agent is employed clubs are organized and demonstration projects outlined for junior farmers. These young farmers are taught the elementary principles of agriculture and live-stock production by county agricultural agents and specialists. In many instances their work has been the means of convincing their fathers that the application of scientific principles to agricultural and live-stock production is of great benefit, and often it has brought about a complete change in agricultural practices on their fathers' farms. In many counties the agent enrolls from 200 to 300 club members each year. In 1916 there were approximately 15,000 boy members of the various agricultural clubs in Texas, and in 1922 this number had increased to about 25,000.

In 1910 the first girls' club was organized in Texas and until 1916 county home demonstration agents laid primary emphasis on the work for girls. The plan was to gain the confidence of the farm housewife by first having won that of the girl in the home.

This work in the outset dealt primarily with production and economic projects, such as the growing and canning of fruits and vegetables on the farm. The home demonstration agents have enrolled approximately 15,000 girls in clubs each year. These young home-makers have a four-year project outlined for them when they enroll, and a large percentage of the number complete the full term of supervised club projects.

Substantial progress was not made in home demonstration work for women until as late as 1916. As a result of the work with girls the women of the State began to take a deeper interest in home economic extension work. There are now about 20,000 women enlisted in the home economics clubs under the direction of home demonstration agents. They have realized that the Smith-Lever Act was passed as much in their interest as that of the farm men and boys.

Texas now maintains the largest Extension Service in the United States. It exceeds all other states in expenditures for this work, with the exception of Illinois. In 1920 the total expenditures of all the states amounted to $14,658,079.92. Illinois expended $662,877.22 and Texas $654,609.46. Texas ranks fourth in expenditures for county home demonstration work and fourteenth in expenditures for boys' clubs. On January 1, 1923, Texas had 160 county agents, seventy women home demonstration agents, ten assistant county farm demonstration agents, five assistant home demonstration agents, fifteen men

specialists, three women specialists, eighteen negro men assistant county agents and nine negro women assistant county agents. This constituted the field force of the Extension Division of the Texas Agricultural and Mechanical College. These men and women are touching in a vital way more than 150,000 farmers, farm women, farm boys and girls with some definite project in agricultural or home improvement. They are making available to the farmer and his family the large store of information that has been accumulated by the research investigators of the United States Department of Agriculture and the land-grant colleges during the past fifty years. Information of great value which has not been utilized heretofore is now being carried to the farmers and farm housewives. They have brought to their very door the results of scientific investigations and have taught them how to apply the results of their researches to the solution of their agricultural and home economic problems. Literally, the earning capacity of the masses has been increased and, in many respects, farm residence has been made more desirable.

THE RURAL CHURCH

The rural church has exerted a great influence in Texas. The pioneer farmers of the State were generally men of religious convictions. Church services, while usually held only on one Sunday in each month, were well attended. These gatherings were enjoyed, not only for their devotional advantages

but because they provided opportunity for social intercourse. The circuit rider and itinerant preacher made their rounds from month to month, usually traveling on horseback. They carried their Bibles, hymnals, church disciplines, and a few religious tracts in their saddle-bags. They were usually welcome visitors in the rural homes, for they disseminated news of the outside world and supplied information about crops and social events of their neighbors at a time when newspapers were not as common as they are today.

The annual camp meeting was an event that was looked forward to with great anticipation. These meetings were usually held after the crops were laid by in the early summer. They brought men, women, and children together from great distances. Some came and camped on the grounds; others arrived in wagons, buggies, and on horseback from their homes day after day. The services were usually held under brush arbors or in school-houses. Between the hours for religious services the children played games and the adults discussed questions of community interest, sang and entertained themselves in various ways. The ministers who conducted these seasonal meetings were usually very earnest and zealous. Emphasis was laid on future punishment for sin and reward for righteous living in the hereafter. These fervent pleas usually made a profound impression on those who heard them and often resulted in many conversions. The days of the camp meeting have passed in Texas, except in the more inaccessible sections.

Changes in methods and facilities of transportation and communication have produced marked changes in religious practices throughout the rural communities. The number of church organizations and the membership in the various religious denominations greatly increased between 1880 and 1900. Rural churches were built in many communities. The buildings usually consisted of a large frame structure with a tall spire rising from the roof at one end. These buildings were attractively located in a beautiful grove or on some commanding hilltop. Keen rivalry often existed between the two leading denominations in the rural community. Great emphasis was laid on church doctrines and lines were very definitely drawn on the basis of creed.

The Southern Baptists and the Methodist Episcopal Church South were the leading denominations in membership in most rural sections. Religious debates were not uncommon and these always attracted great interest. Differences arose from time to time within denominational groups. These were usually due to conflicting interest of leaders or opposing views concerning church organization. One of the most notable was the disruption among the Baptists of the State. A split in the ranks occurred over policies of organization and for years a bitter conflict was waged between the two groups. One of the Baptist groups had 3,362 organizations in the State in 1916 and the other had 1,995. There are many places in which there is more than one organization of Methodists, Presbyterians, or other denomina-

tional groups. These divided denominational elements were usually confined to the towns and cities rather than to the rural communities. Regardless of these conflicts and tendencies, these religious forces exerted great influence on the moral and religious life of the State. The prohibition movement, for example, had its beginning in this period. Many of the religious leaders of earlier days were identified with this movement and some of them have lived to see the people vote the State dry and the national prohibition amendment adopted.

There has been a steady decline in the influence of the rural church in recent years. Many of the buildings have been abandoned and torn down. In some rural churches remnants of the larger memberships remain. The shift of the population to urban centers and the substitution of farm tenants for owners in many counties have affected adversely the interest of the rural church. However, these social changes have not necessarily meant that there has been a general decline in religious interest on the part of the people. Texas ranked sixth in 1916 in the number of members of religious organizations in the United States. In that year there were 14,316 religious organizations in the State, with a total membership of 1,784,620. The total number of church edifices was 11,157 and there were 1,692 additional buildings used for religious purposes. The total number of Sunday schools was estimated at 10,772, with 91,062 teachers and 918,374 pupils enrolled. The available statistics do not separate these into ur-

ban and rural groups, but it is certain that the number and membership in rural churches have declined in recent years.

However, there are many strong rural churches in the State, but these are usually in communities where there is a large foreign element. The Census Bureau reported nineteen languages used in the various religious services in 1916. The number of organizations using foreign languages was 930 and the membership was estimated at 337,173, most of which are in rural communities. The best rural churches are usually in counties where there are large foreign elements of Germans, Austrians, Mexicans or Italians, and the faith of those who are identified with these churches is usually Lutheran or Catholic. However, here and there throughout the State good organizations of other denominations are found.

RURAL YOUNG MEN'S CHRISTIAN ASSOCIATION WORK

One of the activities of the State Young Men's Christian Association is that of county work. The state organization maintains a paid secretary who devotes all of his time to this activity. The report of the State Executive Committee of the Young Men's Christian Association for 1922 shows that four counties are organized for rural work. These are Harrison, Hidalgo, Hunt, and Angelina. Each has a paid secretary. According to this report there were twenty-one communities organized in three of these counties; 167 boys attended summer camps for recreational and religious purposes; 461 attended boys'

conferences; twelve runaway boys were restored to their homes; 250 ex-service men were aided in securing their allotment of funds; 800 boys were enrolled in organized Bible study groups; and 387 made Christian decisions during the year.

The rural program of the State Young Men's Christian Association contemplates the following activities: Bible study, debates, discussions, agricultural study, handicraft, educational excursions, vocational guidance talks, recreational stunts, group games, community play days, thrift campaigns, and in counties with large foreign populations Americanization programs are contemplated.

THE RURAL PRESS

There are 1,180 newspapers in Texas, about 700 of which are rural or small town papers. According to the secretary of the Texas Press Association, the average circulation of the country newspapers is 780. A. D. Jackson, executive assistant of the Agricultural Experiment Station of the Agricultural and Mechanical College, estimates that at least 500,000 families in Texas subscribe for the local paper. The rural press probably has a more extensive contact with the people than any other social agency.

The census of 1920 reports four newspaper plants in Texas that are valued at more than $1,000,000 each, eleven valued between $100,000 and $500,000 each, 160 at $25,000 to $100,000 each, 368 at $5,000 to $20,000, and 490 valued at less than $5,000.

The county newspapers, as a rule, are published in plants valued at less that $20,000.

There has been much improvement in the quality of the material in county newspapers in recent years. The county press in the past has not fully appreciated its obligation to the people and its opportunity for improving rural economic and social life, but much advancement has been made in this respect.

Farm journals and agricultural papers are an important asset to Texas. The Farm and Ranch, an attractively published weekly farm paper, is the oldest in the State and has the largest circulation. It contains much seasonal information on agricultural topics and the numerous illustrations that appear on its pages from week to week make it one of the most attractive farm papers published in the United States. It is very ably edited and the staff correspondents are specialists in the several fields in which they write. The Farm and Ranch is published at Dallas by Colonel Frank P. Holland.

The Progressive Farmer, which enjoys a large circulation in the southern states, publishes a Texas edition. This is a weekly and contains a large amount of seasonal information on agricultural topics. The Texas edition of the Progressive Farmer is ably edited. A feature of this paper is the special editions that are published from time to time throughout the year, such as the reference edition, the fertilizer edition and regional editions devoted to the character of production in some particular section of the State.

The Southland Farmer, published at Houston, is a monthly. This paper stresses the financial and economic aspects of agriculture. Its editorial discussions cover a wide range of topics relating to marketing and the financing of farm operations.

The large daily papers of the State devote considerable space to agricultural news items. Staff articles on agricultural subjects are published from time to time and editorial comment on agricultural problems and policies frequently appear in these daily papers. The Dallas News publishes a Semi-weekly Farm News edition. This paper has a large circulation and the timeliness of its contents gives it great value to the farmer.

There are also a number of agricultural journals published in the State which are devoted to special industries, such as The Rice Journal, The Poultry Journal, The Cattleman and The Sheep and Goat Raisers' Magazine. Publications of a different nature but of value to agriculture include a miscellaneous group of papers, such as Texas Today, The Southwest Magazine, Texas Business, published by the Texas Commercial Association, and The Texas Commercial, Farm and Industrial News, published at Sugarland, Texas.

RURAL WORK OF THE RED CROSS

Since the close of the war the Red Cross has extended aid to rural communities by placing nurses in several counties. Local Red Cross agencies have co-

operated in improving living conditions and the health of the rural population. Special attention has been given to the health conditions of school children in rural communities.

The Vocational Rehabilitation Act extended its benefits to persons injured in agriculture, provided the several states accept the benefits by duplicating federal funds made available under the provisions of this act. Up to January 1, 1922, thirty-five states had accepted the benefits of the act, but Texas is not included in this list. While the number of farmers who receive physical injury in connection with their employment is comparatively small, still there are quite a number who have been injured in gin, mill or other farm machinery accidents. Texas should accept the benefits of this act in the interest of all such persons and extend them the benefits available through rehabilitation agencies.

CHAPTER XIV

HUMAN FACTORS AND RURAL LIVING CONDITIONS IN TEXAS

Increasing attention is being given to the human element in agricultural production. Farmers vary greatly in their ability as producers. Efficiency of production is influenced by health, skill, scientific knowledge, energy, interest, aptitudes, and willingness to coöperate with others.

Business success in agricultural endeavor is promoted by the moral qualities of honesty, courage, patience, and fidelity. The social virtues of aptitude for leadership, the spirit of service, and mental capacity for initiative are measures of rural welfare. H. C. Taylor has a chapter in the revised edition of his Agricultural Economics entitled "The Human Basis of Agricultural Production." In this chapter he defines the high type of farmer as being one who "coolly acts in conformity with economic forces, regarding it as a duty to himself, to his family and his country to make the right use of the agencies of production, and to deal honestly and fairly with all men." [1]

These qualities differ widely in racial groups. Natural aptitudes vary within wide limits in individuals of the same race. Productive efficiency is

[1] *Agricultural Economics* (1919), Chapter 11, p. 109.

also influenced by economic motive. This principle was in John Stuart Mill's mind when he wrote that "the same person who has plowed and sown must be permitted to reap." An attempt will be made to analyze these factors in Texas as a means of appraising the capacity of the population for rural development.

The population of Texas was 4,663,228 in 1920.

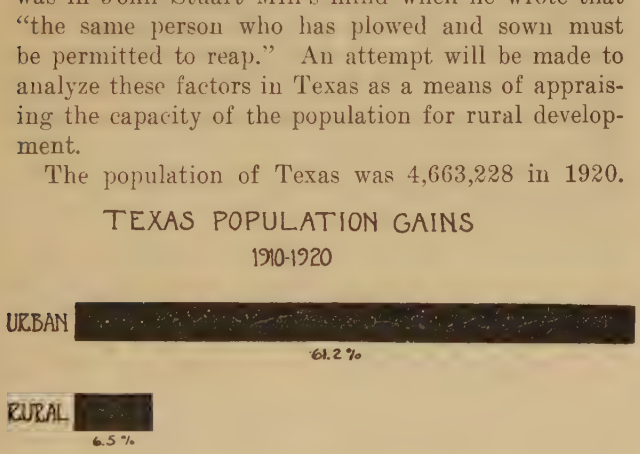

FIG. 10.—Gains in population.

It increased 766,686, or 19.7 per cent, from 1910 to 1920. Texas continues to rank fifth among the states in population, being exceeded only by New York, Pennsylvania, Illinois, and Ohio. Of the total population of Texas, 3,150,539, or 67.6 per cent, are rural and 1,512,689, or 32.4 per cent, are classed as urban.[1] Of the rural, 2,787,531 people live in unincorporated territories and 363,008 in incorporated places. The relative gains of cities over the country during the last decade shows the same tendencies as

[1] The Census Bureau includes all towns with 2,500 inhabitants or more as "urban."

other states. Figure 10 above illustrates this tendency in Texas. The State is not typical of the nation in the proportion of the rural to urban population. Of the total of the United States, 51.4 per cent are urban dwellers and 48.6 per cent are classed as rural. However, there are nineteen states that have a higher percentage of rural population than Texas. In 1920 there were 156 counties in the State that had no incorporated towns with as many as 2,500 inhabitants or more. Seven counties have in excess of 40,000 rural people. All of these counties have one of the large cities located in them and the soil fertility and good marketing conditions account for their large rural population. The following tabulation shows a comparison of urban and rural population, the percentage of urban to the total and the percentage of increase during the last decade in these seven counties:

	Population 1920		*Per Cent of Urban in Total*	*Per Cent Increase*	
Counties	*Urban*	*Rural*	*Pop.*	*Urban 1910-1920*	*Rural 1910-1920*
Bexar	161,379	40,717	79.9	67	76.6
Collin	6,677	42,932	13.5	41.6	—3.1
Dallas	158,976	51,575	75.5	72.6	18.2
Ellis	15,182	40,518	27.3	27.9	—3.0
Grayson	32,096	42,069	43.3	23.2	5.3
Harris	142,356	44,311	76.3	65.9	48.2
McLennan ..	41,605	41,316	50.2	41.7	—5.9

The figures for these counties are sufficient to illustrate several tendencies in Texas. In the first place, the percentage increase in the urban popula-

tion in the four counties with the largest cities is unusually large. In the second place, two of the counties with no large cities show an actual decrease in the percentage of rural population and the third county shows a very small increase. In the third place, these three counties show a fairly large percentage increase in urban population, which indicates the development of one or more towns to which the rural people have probably moved. Thirty-eight counties of the State report a decline in the rural population between 1910 and 1920. This means that there was a shift of the rural population to the larger towns or to the rural sections of other counties. Both the increase and decrease in rural population was abnormally high for special reasons in some counties. For example, the decrease was 75.4 per cent in Valverde County, 50.7 per cent in Potter County and 43.7 per cent in Howard County, while the increase was 82.6 per cent in El Paso County, 85.9 per cent in Hidalgo County and 94.4 per cent in Lubbock County. Protracted drought conditions about the time the last census was taken account for this abnormal decline in these counties, and unusual agricultural advantages, due principally to irrigation, probably explain the abnormal increase in the population of the other counties.

COLOR AND NATIVITY OF TEXAS FARMERS

The farm population is distributed between native whites, foreign born whites, farmers of mixed parent-

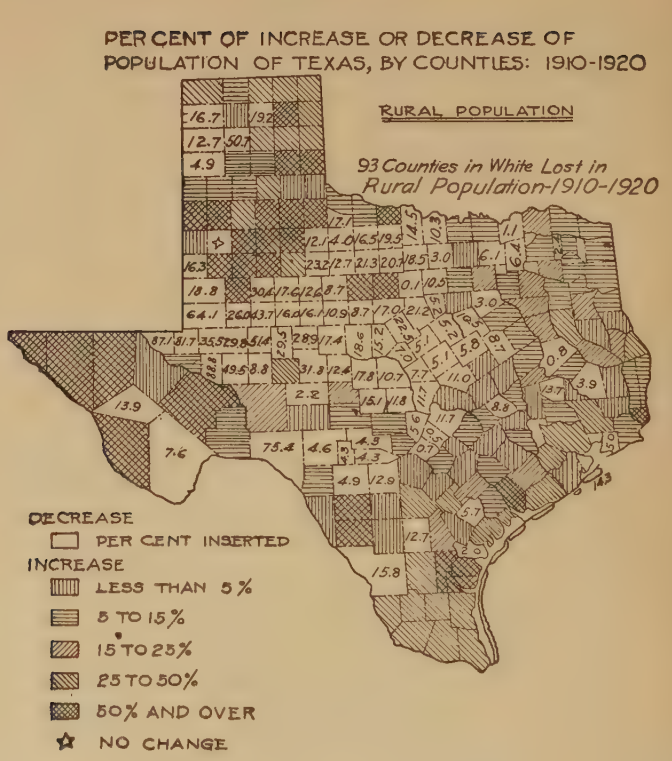

Fig. 11.—Population chart.

age, and colored farmers. The distribution of the farm population is indicated by the following tabulation compiled from the 1920 census figures for Texas:

COLOR OR RACE AND NATIVITY OF THE RURAL POPULATION OF TEXAS COMPARED WITH THE TOTAL POPULATION

Color, Race and Nativity	*Number*			
	Total Population		*Rural Population*	
	1920	*1910*	*1920*	*1910*
White	3,918,165	3,204,848	2,629,978	2,446,314
Negro	741,694	690,049	518,321	511,185
Indian, Chinese and Japanese	2,321	1,637	2,240	939
Native white, total	3,557,646	2,964,864	2,437,509	2,292,421
Native parentage	3,112,262	2,602,950	2,161,256	2,044,736
Foreign parentage	276,670	227,370	173,392	158,849
Mixed parentage	168,714	134,535	102,861	88,836
Foreign born white	360,519	239,984	192,469	153,893

This table brings out several facts of importance: (1) The white farm population predominates and compares favorably with the total whites of the State. (2) The negro farm population compares favorably with the total negroes of the State. (3) The ratio between the combined population of foreign and mixed parentage engaged in agricultural pursuits and the total of foreign and mixed parentage is not as great as in (1) and (2). This is due to the large Mexican population of the State in comparison with the total of other foreign groups. A larger percentage of Mexicans live in cities than any other foreign group. (4) The Indian, Japanese, and Chinese farmers are a negligible factor in Texas agriculture. The census of 1920 reports only 2,153 Indians, 29 Japanese and 5 Chinese farmers in Texas. The number of farms operated by negroes increased from 69,816 in 1910 to 78,597 in 1920.

The total negro population of the United States increased from 9,827,763 in 1910 to 10,463,131 in 1920. That of Texas was estimated at 741,694 in 1920, which was an increase during the present decade of 51,645. Of this number 223,373 were classed as urban and 518,321 as rural. There were 196,055 negroes in Texas twenty-one years of age or over in 1920. Counties having the largest negro population include Anderson, Bastrop, Bexar, Bowie, Brazoria, Brazos, Burleson, Cass, Cherokee, Colorado, Dallas, Dewitt, Ellis, Falls, Fannin, Fayette, Fort Bend, Freestone, Galveston, Gonzales, Grayson, Gregg, Gaines, Guadalupe, Harris, Harrison, Jefferson, Lamar, Leon, Limestone, McLennan, Marion, Milam, Nacogdoches, Navarro, Panola, Pope, Robertson, Red River, Rusk, San Jacinto, Shelby, Smith, Tarrant, Travis, Upshur, Washington, Wharton, and Williamson. All of the counties having a large negro population are in south, east, or east-central Texas. Most of them are large cotton-producing counties.

Much has been said in recent years of the migration of the negroes to the northern and eastern states, but in only five of the thirteen southern states is an actual decrease in negro population reported during the period from 1910 to 1920. However, the increase was relatively small. The migration of negroes from Texas has not been as great as from other southern states. The farm labor situation has not been seriously affected as a result of this situation up to the present time.

The foreign-born white farmers of the State cul-

tivated a total of 5,601,776 acres, or 2,113,796 acres of improved land comprising 29,774 farms. The value of land and buildings on farms cultivated by foreign-born whites was estimated at $248,122,653. The largest number of these farmers in Texas come from Mexico, Austria, Germany, Sweden, Italy, and Poland. The Mexicans constitute by far the largest number as reported in the 1920 census. They are reported to have cultivated 10,877 farms in Texas in 1920. The number has increased very rapidly since the war. The counties having more than a thousand Mexicans are Atascosa, Bastrop, Bee, Bexas, Brewster, Brooks, Caldwell, Cameron, Comal, Dallas, Dewitt, Dimmit, Duval, Eastland, ElPaso, Falls, Fort Bend, Frio, Galveston, Goliad, Gonzales, Guadalupe, Haines, Hays, Hidalgo, Jackson, Karnes, Kleberg, LaSalle, McLennan, Maverick, Medina, Milam, Nueces, Pecos, Presidio, Robertson, San Patricio, Starr, Tarrant, Travis, Uvalde, Valverde, Victoria, Webb, Williamson, Wilson, and Zapata. The Mexican population is concentrated in the counties in southern and southwestern Texas and along the Mexican border. El Paso County reported 38,625 Mexicans, Cameron County 9,914, Hidalgo 14,601, and Webb 15,140. Large Mexican populations are reported in all of the counties having big cities, including Tarrant County, in which Fort Worth is located, and Dallas County, in which is the city of Dallas. The largest Mexican population is in Bexar County, in which San Antonio is situated, which reported 32,934 Mexicans in 1920.

Mexicans in increasing numbers are being employed for farm labor in Texas, but the report of the county population of Mexicans is not an accurate indication of the use of this element for agricultural purposes. Large Mexican populations are living in some counties where agriculture is not an important enterprise. On the other hand, large numbers of Mexicans are reported from counties like Bexar where there is a large city population. It should be observed, however, that these centers are sources of supply for seasonal farm labor. There is a large floating population of Mexicans that drifts out over the State during the season of cultivation and harvesting and supplies the farmers with labor for the excess needs. The report of large numbers of Mexicans in good agricultural counties like DeWitt, Gonzales, Milam, Robertson, and Williamson indicates that many are engaged in farming, either as owners or tenants.

Negroes and Mexicans are the principal source of the farm labor supply, the negro for south, east and east-central Texas, and the Mexican for south and southwest Texas. While these two labor elements are not equally adaptable for all kinds of agricultural enterprise, they are reasonably well suited to the types of production in the several sections in which they are largest.

The aptitudes and efficiency of foreign-born groups that engage in agriculture depend very largely on the country from which they come and the nature of their employment in their native land. The in-

fluences of native environment and racial aptitudes have revealed themselves in all immigrant groups. The older ones came largely from northern Europe and included the Germans, Norwegians, Swedes, and Danes, most of whom lived in rural sections. They established colonies and engaged in farming. In most cases they proved to be more skilled in agricultural production than the native farmers. They were generally thrifty and industrious. As a result, they acquired farm homes and became prosperous.

The Germans constitute by far the largest of the immigrant groups from northern Europe. The total number of foreign-born Germans was reported at 31,062 in 1920, and there are thousands of farmers of German descent. The foreign-born Swedes in Texas number 4,536, the Norwegians 1,740, and the Danes only 1,508. The counties reporting the largest foreign-born German population include Austin, Bexar, Comal, Dallas, DeWitt, Fayette, Galveston, Guadalupe, Harris, McLennan, Tarrant, Travis, Washington, and Williamson. While the Swedes do not constitute a large foreign group in the farm population, there are a few in many counties. The largest Swedish populations are in Travis and Williamson counties. A few Swedes and Danes are also found in many counties, but in no county do they constitute a large number. Bosque County has the largest number of Norwegian farmers and Wharton County, the most Danes.

In recent years immigrants have been coming to

America in large numbers from southern and southeastern Europe. They are, as a rule, unskilled and untrained in agricultural pursuits, but many come from rural communities. Nearly two-thirds of the Italians from southern Italy and one-fourth of those from northern Italy who have immigrated to this country were farmers in their native land, but only a limited number have become farmers in this country. The immigrants from this part of Europe differ greatly in their ability as farm producers and community builders.

In 1920 the foreign-born Italians in Texas were reported at 8,024. The largest Italian farm colony in the South, numbering approximately 2,000 persons, is near Bryan, in Brazos County. As a rule, the Italians are thrifty and industrious. Most of them are ambitious to own their own farms and rapidly advance from farm laborers to tenants, and soon acquire small farms of their own.

The Bohemians constitute a successful farm group in Texas. The number of foreign-born was reported at 12,819, but the actual number of farmers of this immigrant group is much larger. They constitute an important agricultural element in many Texas counties, including Austin, Bell, Brazos, Burleson, Colorado, Dallas, Fayette, Hill, Lavaca, McLennan, Milam, Wharton, and Williamson.

Austria and Poland have also contributed slightly to the farm population of Texas. Colorado, Lavaca, Milam, and Taylor counties have the largest number of Austrian farmers, and Brazos, Falls, McLellan,

Robertson, and Washington counties report the most tenant farmers.

TENURE OF FARMS IN TEXAS

The efficiency of production is influenced not only by racial capacity and industrial aptitudes, but also by the nature of the tenure. In his Travels in France and Italy, Arthur Young says: "Give a man the secure possession of a bleak rock and he will turn it into a garden; give him a nine-year lease on a garden and he will convert it into a desert." All things considered, it is to be assumed that a farm owned by the owner is preferable to its cultivation by a tenant. It is well known that the extent of tenancy in Texas has affected production and rural social life. The facts relating to farm values, therefore, will be presented in some detail for the purpose of indicating the extent of this influence on rural conditions. The increase in farm tenancy in Texas compared with that throughout the United States is indicated in the following tabulation:

PERCENTAGE OF TOTAL NUMBER OF FARMS CULTIVATED BY TENANTS IN THE UNITED STATES AND IN TEXAS AT EACH DECENNIAL PERIOD SINCE 1880

	1880	1890	1900	1910	1920
United States	25.6	28.4	35.3	37.0	38.1
Texas	37.8	41.8	48.7	52.6	53.3

The Bureau of the Census did not collect data on farm tenancy previous to 1880. It will be observed

that the percentage in both the United States and Texas has continuously increased since that time, but the rate of increase has declined in the last three decades. The percentage of increase for each decade has been higher in Texas than for the nation as a whole. In fact, the percentage of farms operated by tenants in Texas in 1880 slightly exceeded that of the United States, including Texas, in 1910. It will also be observed that more than half of the farms in Texas are now operated by tenants.

A closer approximation of the effects of tenancy may be obtained from the census figures showing the distribution on the basis of the different types of tenure. The classification is as follows: (1) farmers who cultivate only the land they own; (2) farmers who cultivate their own farm and rent additional land; (3) managers, or those who direct the farm operation for the owners; (4) tenants who have no equity in the land and only share in the enterprise on the basis of a lease with the owner. The following tabulation on page 389 presents this comparison and distribution:

This table presents several important facts. (1) The total number of farmers increased 18,263, or 4.4 per cent, during the last decade. (2) The number of farms operated by tenants increased 12,734, or 5.8 per cent, during the same period. (3) The share tenants and croppers, which comprise by far the largest number of tenants, increased 14.2 per cent in the last decade. The share tenants are approximately twice the number of croppers. (4)

NUMBER OF FARMS BY TENURE

Tenure	*Number of Farms*		*Increase*	
	1920	*1910*	*Number*	*Per Cent.*
All Farmers	436,033	417,770	18,283	4.4
Owners	201,210	195,863	5,347	2.7
Owning entire farm	171,427	167,515	3,912	2.3
Hiring additional land	29,783	28,348	1,435	5.1
Managers	2,514	2,332	182	7.8
Tenants	232,309	219,575	12,734	5.8
Share tenants	142,641	184,753	26,269	14.2
Croppers	68,381			
Share-cash tenants	4,968	8,639	—3,671	—42.5
Cash tenants	11,363	17,549	—5,136	—29.3
Standing renters	1,050			
Unspecified	3,906	8,634	—4,728	—54.8

Both the cash and standing renters decreased in number during the past ten years, there being only 11,363 cash tenants in the State in 1920. The following tabulation presents these facts in a slightly different way:

NUMBER OF FARMS AND PERCENTAGE DISTRIBUTION BY TENURE 1920 AND 1910

Tenure	*1920*	*1910*	*Percentage of all Farms*	
Total number of all farms	436,033	417,770	100	100
Farms operated by owners	201,210	195,863	46.1	46.9
Farms operated by managers	2,514	2,332	.6	.6
Farms operated by tenants	232,309	219,575	53.3	52.6
Share tenants	211,022	184,753	49.5	46.3
Share-cash tenants	4,968	8,639		
Cash tenants	12,413	17,549	3.7	6.3
Unspecified tenants	3,906	8,634		

These figures do not require further interpretation, but they suggest a question of great importance to the future of Texas agriculture and the maintenance of the social order. *Is it possible to sustain a prosperous agriculture and maintain a high standard of rural civilization when more than half of the farms of the State are operated by those who do not own the land they cultivate?* This question, however, needs to be considered in the light of the racial factors involved in the farm tenantry situation and the geographical distribution of those who cultivate the soil on this basis of tenure.

The census does not separate tenants by racial groups, but the tenure by white and colored farmers is given. The following table, compiled from the census figures, presents these facts.

FARM ACREAGE AND VALUES, BY TENURE AND COLOR
1920

Color and Tenure	*All Farm Land in Acres*	*Improved Land in Farms*	*Value of Land and Buildings*
All farms	114,020,621	31,227,503	$3,700,173,319
White	109,561,481	28,066,949	3,474,000,091
Owners	66,438,950	14,546,460	1,883,769,434
Managers	14,249,257	619,457	203,697,405
Tenants	28,873,274	12,901,032	1,386,533,252
Colored	4,459,140	3,160,554	226,173,228
Owners	1,805,196	1,035,564	68,170,518
Managers	83,603	17,533	2,827,325
Tenants	2,570,341	2,107,457	155,175,385

The real significance in these comparisons is in the figures relating to improved lands and values of

lands and buildings. While there were a third as many colored as white tenants in 1920, the former cultivated only one-sixth the number of acres as the latter. A comparison of the values of land and buildings utilized by white and colored tenants is even less favorable to the colored farm tenants. This fact is more clearly brought out in the following tabulation, which compares the number of farms cultivated by white and colored tenants on the basis of tenure.

TENURE OF FARMS BY COLOR: 1920 AND 1910

	Number of Farms		*Increase in*	
Color and Tenure	*1920*	*1910*	*Farms*	*Per Cent.*
All Farms	436,033	417,770	18,263	4.4
White	357,249	347,852	9,397	2.7
Owners	177,671	174,631	3,040	1.7
Managers	2,380	2,251	129	5.7
Tenants	177,198	170,970	6,228	3.6
Colored	78,784	69,918	8,866	12.7
Owners	23,539	21,232	2,307	10.9
Managers	134	81	53	....
Tenants	55,111	48,605	6,506	13.4

This table shows a comparatively large increase in the percentage of farms operated by colored farmers during the past decade. However, the total number of farms cultivated by colored tenants in proportion to the total number of farms operated by them is abnormally large. The number of farms cultivated by white owners is slightly larger than that by white tenants. This indicates that the percentage of increase in farm tenantry in Texas is largely

traceable to the relatively large proportion of colored tenants to farm owners. Finally, this comparison is brought out more clearly in the averages which are condensed and summarized from census tables as follows:

AVERAGE ACREAGE AND VALUES BY TENURE AND COLOR: 1920

Color and Tenure	Average Acreage per Farm		Average Value of Land and Buildings	
	All Land	Improved Land	Per Farm	Per Acre
All farms...	261.5	71.6	$8,486	$32.45
White	306.7	78.6	9,724	31.71
Owners	373.9	81.9	10,603	28.35
Managers	5,987.1	260.3	85,587	14.30
Tenants	162.9	72.8	7,825	48.02
Colored	56.6	40.1	2,871	50.72
Owners	76.7	44.0	2,896	37.76
Managers	623.9	130.8	21,099	33.82
Tenants	46.6	38.2	2,816	60.37

These figures indicate that (1) the acreage in the farms cultivated by negroes is much below the general average, and the value of farms owned by colored farmers is much below the average of all farms and the average of those owned by white persons. (2) The average value of the farms owned by the negro and that of the farms operated by the colored tenant are about the same, although the average acreage cultivated by the colored tenant is smaller than that by the colored owner. This probably means that the colored tenant usually operates farms of white owners which have more valuable im-

provements and better equipment on them than those of colored owners. The fact is that many farms in Texas are under-capitalized; especially is this true of those owned by negroes. (3) The figures relating to farm managers are not significant for this comparison. There are only 134 negro farm managers reported in the census figures. The large acreage under managerial control and the large values indicate that these figures relate to ranches and a few capitalistic farm enterprises, such as the Taft Ranch, located in southern Texas.

A consideration of the geographic distribution of the farm tenants shows that there are eighty-six counties in Texas in which more than half the farms are cultivated by tenants. The type of tenure differs somewhat, depending on the nature of the crop produced and the aptitudes of the individual tenant. Counties in excess of 4,000 farms with more than half of them cultivated by tenants are as follows: Harrison, with 58 per cent of all farms operated by tenants; Hill, with 65 per cent; Hopkins, 52 per cent; Hunt, 60 per cent; Kaufman, 69 per cent; Lamar, 68 per cent; Limestone, 67 per cent; McLennan, 66 per cent; Milam 68 per cent; Navarro, 73 per cent; Parker, 66 per cent; Red River, 65 per cent; Robertson, 60 per cent; Washington, 51 per cent; and Williamson, 60 per cent.

The foreign farm population presents no problem of tenantry in Texas. Out of a total of 177,198 tenants reported by the last census, only 15,205 were of foreign parentage. The foreign element in

the farm population is generally thrifty and energetic. They rapidly climb the "agricultural ladder" to farm ownership. The largest number of foreign born tenant farmers is in Caldwell and Guadalupe counties. The number is negligible in the other counties.

There are in excess of 1,000 native white tenants in Anderson, Bell, Bexar, Bosque, Bowie, Cass, Cherogee, Childress, Coleman, Collin, Comanche, Cook, Coryell, Dallas, DeWitt, Delta, Denton, Ellis, Erath, Falls, Fayette, Gonzales, Grayson, Haskell, Henderson, Hill, Hopkins, Houston, Hunt, Johnson, Jones, Karnes, Kaufman, Lamar, Lavaca, Limestone, McLennan, Milam, Montgomery, Nacogdoches, Navarro, Parker, Red River, Runnels, Rusk, Shelby, Smith, Tarrant, Titus, Travis, Upshur, Van Zandt, Williamson, Wise, and Wood counties. The following counties reported more than 1,000 negro farm tenants in 1920: Anderson, Bowie, Brazos, Cass, Cherokee Falls, Fort Bend, Houston, Kaufman, Lamar, Limestone, McLennan, Milam, Navarro, Panola, Red River, Robertson, Rusk, Smith, and Washington.

Generally speaking, the largest number of white farm tenants is in the large cotton-producing counties of central-west and northern Texas. The largest number of negro farm tenants is in south, east and east-central Texas. The rich valleys of the principal rivers of central Texas are almost exclusively cultivated by negro tenants and a comparatively few farm laborers.

The white tenants in the black land sections are generally of the cash and share type. Negroes are generally share tenants and croppers. The greatest problem of agricultural production is the share tenant and the cropper. Broadly speaking, the problem of farm tenantry centers around the following points: (1) the effect of agricultural production on cultivation of land by a number of tenants out of due proportion to actual farm owners; (2) the undesirability, from the standpoint of agricultural production, of a large farm population composed of tenants who have abandoned the hope of acquiring a farm home; (3) the undesirability, from the standpoint of the good of the rural community, of a large farm population composed of tenants who are economically and socially indifferent to community betterment; (4) the inadequacy of farm tenantry as a moral and religious asset.

RURAL LIVING CONDITIONS IN TEXAS

Standards of living have greatly changed in Texas since the days of the *empresario* and the early pioneer. Living conditions have not been uniform throughout the State during the same period. Environment has exerted its influence in Texas, as elsewhere. Social life in the western range country has been vastly different from that of east Texas. The advance of civilization has greatly changed social conditions and modified the habits and customs of the people.

Social life and standards of living in Texas today reflect many influences of an earlier time. It would be impossible to account for many usages and customs peculiar to Texas without knowing something of the mode of living, customs and social practices during the days of the Republic, and even before that period. The pioneers gathered in Texas from every section of the country and some came from foreign lands. Self preservation made it necessary for them to group together, and a new environment compelled them to adapt themselves to a new situation. The accounts of early writers as to the manner of making these adjustments constitute important historical and sociological information.

The characteristic Anglo-Saxon love for a home of his own was the impelling cause of his braving the perils of the wilderness and undergoing the hardships incident to an undeveloped country. The colonists came to Texas in the early part of the eighteenth century to better their conditions by securing land of their own on which they could build a home. These early homes were "log cabins, with clap-board roofs, retained in place by heavy logs extended across them from one side of the roof to the other, held in position by the split hearts of the 'cuts' of the trees from which the boards were made; the floors were of dirt or puncheon slabs hewn from tree-cuts; the chimneys were of 'cat and clay' or stone where it could be had." [1] In time, the cabin was

[1] Wooten's *A Comprehensive History of Texas*, Volume 1, Chapter 9, p. 593.

built double with a hall between, a gallery on the front and a shed-room on the rear. The floors were made by planks sawed by hand.

In the chapter of Wooten's *History of Texas* from which the above quotation is taken, Guy M. Bryan is quoted as saying: "Families were to be found very comfortably established, however, in double log cabins with stone chimneys and plank floors; then again, you saw cabins of logs with the bark on, one room for the whole family, comers and goers, and for the Texas wind which found the crevices between the logs and sometimes helped the fire to set a wooden chimney to burning. In the latter case—that of the log fireplace conspiring with the fire to roast you on a cold day—you had nothing for it but to climb up on the outside and throw your chimney down, thus leaving the small room at the mercy of the roaring norther."

Furnishings were in keeping with the crude dwellings. Distances were too great and the conditions of travel too arduous to bring much furniture and many household conveniences to the new country. In one of a series of letters written at Bolivar, Texas, in December, 1831, and published in London, Mrs. Mary Austin Holley gives some advice to prospective colonists on this subject. She says that "those who must have a feather bed, had better bring it, for it would take too long to make one; and though the air swarms with wild geese, a feather bed could not be got for love or money. Everybody brings pillows and bed linen. Mattresses, such as

are used, universally, in Louisiana, and are very comfortable, are made of the moss, which hangs on every tree. They cost nothing but the care and the trouble of preparing the moss. The case should be brought. Domestic checks are best, being cheap and light, and sufficiently strong. The moss is prepared by burying it in the earth, until it is partially rotten. It is then washed very clean, dried and picked; when it is fit for use. These mattresses should be made very thick; and those who like a warmer bed in winter can put some layers of wool, well carted, upon the moss, taking care to keep this side up." The suggestion is also made that furniture, such as chairs and bureaus, should be brought in separate pieces and put together. "But it must be recollected," says this experienced pioneer woman, "that very few articles of this sort are required, where the houses are small and building expensive. . . . The maxim here is, nothing for show, but all for use."

The food supply of the early Texas settler was usually rather abundant and near at hand. Early writers delighted to tell of the great number of deer and buffalo and other wild game that was found in Texas. Wild geese, ducks, quail, and other species of bird life were in great abundance in the coast country and in other sections. Game was an important source of the food supply of the early settlers. There was a general sentiment about the sale of game. No one would receive money for any kind of game caught by trapping or killed with a gun. It was customary for the hunter to divide the game that he

brought in with his neighbor and it was regarded as an insult to offer to pay for it. Vegetables, fruits, eggs, butter, and chickens were rather plentiful, but such articles as coffee, tobacco, and flour were scarce.

The story is told of one of the settlers who got together money or pelts enough to buy a barrel of flour. The housewife made some biscuit which proved to be very heavy and hard. When they were placed on the table the young boy in the home looked at them curiously, helped himself to one and made for the door with it. In a few minutes he came back for another. The mother, doubting the child's ability to eat the biscuit so quickly, followed him to the front of the house to see what he was doing with it. The ingenious youngster had pushed holes through the center of each biscuit, inserted an axle and triumphantly displayed a miniature Mexican cart. The early writer who described this incident says: "I assure you from my recollection of those pioneer biscuits, they were capable of sustaining a pretty heavy load."

The method of cooking corn is rather interestingly described by Noah Smithwick, a pioneer of the early days, as follows: "They boiled it and fried it and roasted it, either by standing the husked ears on end before the fire and turning them till browned all around or buried them husk and all in hot ashes, the sweetest way green corn was ever cooked. When the corn began to harden they made graters of old tinware, coffee pots being most in vogue. They were ripped open and spread flat on a board and punched

full of ragged holes. They were then bent into an oval and the straight edges nailed to a board. The corn was of the large, soft, white Mexican variety and grated easily, and the bread was very rich and sweet, if a bit heavy. Next came the mortar and sweep. A good, sound tree was cut off some three or four feet above the ground, and the stump was hollowed out by alternate burning and scraping till it would hold sometimes a peck of shelled corn. Then a long pole, to the butt end of which a pestle was attached, was swung into the fork of an adjacent tree and the corn pounded into meal, which, often without sifting or salt, was mixed with water and baked, not a very tempting dish from an epicurean standpoint, but to people who had not tasted bread for months it was a delicious change." [1]

One writer, after discussing the food supply in Texas, cautioned the immigrant that "unfortunately cooks do not grow on trees. The epicure, therefore, who brings with him his morbid appetite must also bring his cook." This advice was increasingly followed as conditions of society in Texas became more stabilized.

Life in a Texas colony is thus described by a member of Austin's colony: "If the great object of man in this life is contentment and to live in a society where each one respects the rights of the other, having the largest share of freedom of thought and action, nowhere has it been realized more

[1] *The Evolution of a State or Recollections of Old Texas Days,* Chapter 2, p. 24.

PLATE XII. A view of Galveston Harbor looking down the bay.

thoroughly than among these intelligent, contented, honest, hospitable, self-supporting communities. Nowhere was a pauper to be found, and rarely a thief. There were no locks, and the latch-string ever hung out. If sickness, misfortune, or distress, came,—as such casualties at times come to all men —warm and sympathetic hearts of neighbors came to soothe and relieve; if a settler was weak-handed in making improvements, or in log-raising, or log-rolling, in ploughing or cultivating his crop, ample gratuitous aid was at hand, and no one suffered for want of this aid." This was probably typical of life in many of the colonies in Texas previous to the days of the Republic.

Life in the colonies of Texas was not barren of amusement and recreation. The people had their balls and parties, neighborhood gatherings for athletic exercises, fishing, picnics, horse racing, rifle shooting, mustang catching, story telling, hunting, and Indian expeditions. Much sport was supplied by hunting mustang horses. It was said that a shot through a certain portion of the top of the neck would stun a horse and cause him to fall. This was called "creasing." It required an expert shot to bring a mustang down and quick action to get a rope on the animal before it recovered its feet and escaped. Sometimes the riflemen would aim a little too low and the bullet would break the animal's neck. Such an experience is described by Smithwick in his book to which reference has been made. One of his companions was watching for an opportunity to "crease"

a mustang. "By and by a drove came down to drink. Selecting a fine specimen, he fired. The horse fell and lay quivering. Gibbs dropped his gun, grabbed his lariat, ran up to the prostrate courser, slipped a noose over his head, and taking a turn around a tree, braced himself and waited for his prize to recover, but the horse never even kicked. He had broken his neck."

Weddings in the colonies were rather infrequent, but when they did occur they were occasions of great social interest. They were usually followed by wedding suppers, which consisted of the best the markets afforded. The food was not served in courses; it was piled on the table in great abundance and the guests gathered about the table and ate as their tastes dictated. After the supper the floor was cleared for dancing. The square dance was the principal form in those days. The music was usually supplied by fiddles manipulated by negroes. The *charivari* was quite common in the early days in Texas. On the night of the wedding the boys would gather from miles around and then go to the house of the bride and groom and with cow bells, cow horns and tin pans would make a noise that would almost raise the dead. After a half hour or more of continuous and deafening noise, the party would quietly disperse.

One of the most interesting customs of early days in Texas and one that has persisted to recent times is that of giving cognomens to men which are derived from their vocations or some predominant character-

istic. For example, "Hog" Mitchell and "Cow" Cooper were so designated because they owned more of these animals than most of their neighbors. "Hustang" Brown acquired his title because of his ability to catch mustang horses. "Dancing Master" Smith and "Parson" Jones were names given because of the professions of these men. "Buck" Jones and "Bill" Underwood were typical designations in those days.

Sunday was a day for visiting. Families would go on horseback or in wagons five or ten miles, take dinner with friends or relatives and return to their homes in the late afternoon. Religious observance was first confined to the family circle where the Bible was read, songs were sung, and prayers offered. The Roman Catholic faith was the legal religion, but the colonists kept the faith of their fathers in such a way as not to give offense to the administrative authorities. In time, school-houses of logs were built in the most densely populated communities. These houses were sometimes used on Sundays for religious purposes, but the shade of a large tree was often used for religious services by preachers of the Protestant denominations who occasionally visited the communities.

Most of the early writers refer to the hospitality of the colonists. The people were described as unusually kind and hospitable. The houses had no locks and the latch-string literally hung on the outside of the door. The passing traveler was always welcome. No charge was ever made for the enter-

tainment that was provided. Isolation and eagerness for news caused the settler and his family to welcome the stranger who always supplied information about conditions in other colonies or news from other sections of the country.

After the establishment of statehood, efforts were often made to combat the opinions that widely prevailed concerning lawlessness in Texas. A typical illustration on this appears in the Texas Almanac for 1873. The writer, referring to the east Texas community in which he lived, says: "There is no one thing in regard to which men are more deceived by misrepresentations than the state of society in Texas. We are not outlaws, cutthroats nor thieves. We are social, clever and sober. . . . Our people are not addicted to political bickerings. We do not ask strangers of their politics or religion, but take them to our homes and churches and bid them welcome."

Social customs and standards of living have greatly changed with the development in economic and industrial conditions. The log cabin has given way, in most cases, to the farm-house, but rural homes today vary greatly in size, attractiveness, and physical comforts. Farm owners in black land sections of central, north and northwest Texas usually live in well built and attractive homes. These are usually in marked contrast to the houses occupied by tenant farmers. Negro tenant houses usually consist of two rooms and a lean-to, or shed-room.

White tenants of the better class have more comfortable and attractive homes, but few tenant houses are painted and scarcely any of them have household conveniences.

Social and recreational activities have undergone great changes in recent years. The days of mustang catching, horse racing, and charivarying are gone. The country picnic and the camp meeting still continue, but they are not so popular as in former years. The improved highway and the automobile have made the moving picture show accessible to most rural people. This movement has supplied more than one need for the dwellers in the open country. Even the county courthouse is no longer as popular as a community center for men who spend their idle days playing dominoes and discussing the politics of the day.

Rural health conditions have steadily improved in Texas. Epidemics of yellow fever and smallpox are no longer menaces to health. Malaria and typhoid fever that were so prevalent in many places in Texas have been greatly reduced as a result of the knowledge and practices of sanitation in and about the farm homes. The prevalence of hookworm and pellagra has been arrested and the number of cases has been reduced greatly by the dissemination of information relating to these diseases. The State Board of Health has done and is doing a great work in disseminating information concerning the cause and prevention of disease among the rural people of Texas.

The standard of living in the rural homes has been raised further by the increasing use of labor-saving devices and through the dissemination of knowledge relating to the scientific preparation of food. The attractiveness of rural homes has been increased by better standards of taste in interior decoration. The number of books, papers, and magazines that are found in country homes has been greatly increased in recent times and their quality very much improved. Many of these changes in the rural home have been brought about through the efforts of the home demonstration force of the Agricultural and Mechanical College.

The appeal of the countryside is stronger today than ever before. Texas is not excelled by any other state in the attractiveness of its rural districts. Life in the open country no longer involves hardships and loneliness as of other days. The advantages of social and recreational life are no longer denied those who live in the open country. The satisfaction of home ownership and the independence of rural life conditions are now appealing as never before to people everywhere. Pope's description of the contented man in his "Ode on Solitude" applies with renewed force to living in the open country in Texas under the new conditions that now prevail.

"Happy the man whose wish and care
A few paternal acres bound,
Content to breathe his native air
In his own ground.

"Whose herds with milk, whose fields with bread,
Whose flocks supply him with attire;
Whose trees in summer yield him shade,
In winter, fire.

"Blest, who can unconcern'dly find
Hours, days, and years, slide soft away
In health of body, peace of mind
Quiet by day.

"Sound sleep by night; study and ease
Together mix'd; sweet recreation,
And innocence, which most does please
With meditation.

"Thus let me live."

CHAPTER XV

THE AGRICULTURAL OUTLOOK IN TEXAS

It seems safe to conclude that Texas has not reached the limit of her agricultural possibilities. In fact, there are many reasons for believing that the greatest development of her agricultural resources is still in the future. The vast area of the State, the diversity of soil and climate, and the topographic variation insure the continued growth of a wide range of products. The limit of plant production has certainly not been reached. New varieties of economic plants will continue to be tested out in promising localities by the Agricultural Experiment Station and some of them will prove adaptable and useful.

There will certainly be larger demands made on the agricultural producers as a result of the increasing population. Texas cities are growing rapidly. The State is just entering an era of commercial and industrial expansion. This means that additional demand will be made on the farmers to provide the food and raw material for manufacturing purposes that the increasing number of people and expanding industrial enterprises will require.

It is not contemplated that intensive cultivation of large areas will be practiced in Texas in the

immediate future. Extensive rather than intensive cultivation will continue until the limits of agricultural expansion have been more definitely reached. Intensive farming will develop to some extent around the large urban centers, no doubt, but this will be largely restricted to horticultural production to meet local market demands. It is reasonable to assume that improved methods of cultivation will result in increased acreage yields. The average yields to the acre of farm crops in Texas are too low at present. Conservation of the soil by terracing, soil improvement by the use of fertilizer and crop rotation, the planting of better varieties of seed and the application of better methods of cultivation will result in better quality of farm products and larger yields to the acre.

There has been a rapid extension of the field crop areas in recent years. Farming has been increasingly practiced in the western and northwestern parts of the State. There is still much land in these sections whose fertility will invite agricultural enterprise in the future, but there is a limit to the possibilities of this expansion. The economic law of diminishing returns will determine this limit. This situation makes it reasonably certain that for a long time to come, and perhaps for all time, vast areas in the western part of the State will be utilized for livestock production. Surface and soil conditions of vast areas seem to insure ranching as an essential enterprise of great importance in Texas. The production of beef cattle, sheep and goats will probably

constitute one of the largest resources of Texas and give her continued high rank among the states of the Union in the value of her live-stock products.

These questions suggest the increasing importance of problems of land utilization in Texas. Soil surveys of many counties, conducted jointly by the Bureau of Soils of the United States Department of Agriculture and the Agricultural Experiment Station of the Agricultural and Mechanical College of Texas, will probably be utilized for a thorough consideration of this question. Increasing attention is being given also to the reclamation of arid lands and the drainage of swamps. Some progress has been made in reclaiming waste lands that were too wet or too dry for profitable cultivation. Topographic and hydrographic surveys are now under way on an extensive scale for the purpose of determining the limit of land utilization. The application of dry-land farming methods has long been practiced in Texas, but these methods have not insured the annual production of profitable crops. Levees, drainage, and irrigation will not only extend the area of tillable land of the State but will increase the certainty of annual crop production.

A comprehensive policy of the conservation of the natural resources seems inevitable. Texas has been slow—in fact, too slow—to undertake seriously this task. The vast forest resources have been greatly depleted and soon will be exhausted; the water resources have not been utilized to an appreciable extent; the game has been almost completely

destroyed; wasteful methods of mining have been partially responsible for the slow development of the mineral resources. A conservation policy is of great concern to the agricultural producers. It is important for the State to acquire ownership of the large areas of the cut-over timber lands of east Texas. This land should be utilized not only for the growth of a new supply of lumber but for game preserves. An adequate conservation policy will also involve state ownership of parks and reservations in certain sections. Texas is unusually favored with desirable sites for this purpose. The mountainous sections of west Texas and the canyon areas of northwest Texas are very desirable for this purpose. Public parks and reservations have æsthetic, educational, hygienic, and economic value of great importance. These should be conserved under a policy of state control and direction. It is contemplated that the State will create a conservation commission with power to coördinate all existing agencies and to purchase and utilize cut-over lands and scenic areas for conservation purposes.

Coördination of existing agricultural agencies is an imperative necessity. An effort has never been made in Texas to formulate a constructive agricultural policy. Administrative laws relating to agriculture have been passed by the Legislature from time to time, as circumstances required. The administration of these laws has not been determined on the basis of a guiding state policy. This has resulted in duplication of effort, conflict of interests,

and waste of public funds. The seriousness of this situation may be indicated by a reference to the number of these activities and the methods of appointment of administrative agencies connected with them. The establishment of the State Department of Agriculture was the first comprehensive act passed in Texas in the interest of agriculture. The Commissioner of Agriculture, who administers the regulatory laws of his department, is elected by the people. The Department of Markets and Warehouses is administered by a commissioner who is appointed by the Governor. The members of the Live Stock Sanitary Commission, with large powers in connection with control work affecting live-stock, are also appointed by the Governor. The Governor appoints the Game, Fish and Oyster Commissioner who administers the laws connected with the conservation of the game and fish resources. The feed control, foul brood, and fertilizer laws are administered by officials of the Agricultural and Mechanical College of Texas who are appointed by the governing board of that institution. All of these agencies are independent of each other and there is no correlating agency between them.

Public welfare demands that something be done about this situation. The creation of a Board of Agriculture to administer all of the regulatory laws of the State seems to offer the best solution to this problem. If it is contemplated that the regulatory activities should be coördinated with the educational and research work of the Agricultural and Mechani-

cal College, it would seem that the Board of Directors of the College might be designated as the Board of Agriculture for the purpose of coördinating and administering all the agricultural activities of the State. The only other solution and one that seems less promising of satisfactory results would be independent boards for the College and the regulatory activities, with joint committees to coördinate the research and regulatory activities. This plan has the virtue of preventing duplication of effort and wasteful expenditure of public funds, while at the same time it would adjust the several lines of activities to each other.

There has been great improvement in the credit facilities available for farm operations in recent years. Credit practices in the past have been far from satisfactory, but the days of "store credit," with high and uncertain interest rates for farm supplies and restricted competition, have passed. The farmer is now being provided with all the credit required by agricultural enterprise. Short term personal credit for productive purposes is available through local banks, assisted by the Federal Reserve Bank. Long term credit for the purchase of land and permanent improvements thereon is available through the Federal Land Bank system. Intermediate credit has recently been provided by the passage of the Lenroot-Anderson Bill. While intermediate facilities have just become available, there is every assurance that adequate credit is now available for farm operations. The farmer's most serious

problem now is to restrict his loans to his ability to pay off his obligations. *The peril of the agricultural producer at this time grows out of the temptation to borrow in excess of the requirements of his farm enterprise.* Safe banking practices and good business judgment will be greatly needed to safeguard this situation.

Coöperative marketing has developed rapidly in Texas and gives promise of success. Coöperation by farmers in the marketing of their products on the basis of commodities involves important changes in financing farm operation. This is especially true in the case of coöperative marketing of cotton. One of the most serious difficulties connected with the organization of coöperative marketing associations has grown out of the prevailing practices of financing farmers in this State, but gradually these changes are being made and increasing success is attending the efforts of those who are directing the several commodity marketing associations. No movement ever started in Texas affecting the interests of farmers has developed so rapidly as this plan of selling farm products. The results already attained give promise that coöperative marketing will succeed and that in a few years every important crop will be sold on some plan of coöperation.

Rural life in Texas has been experiencing gradual readjustment in recent years. The population has been rapidly shifting. The native white farmers in many localities have sold their land to foreign born immigrants and moved to nearby towns or settled on

farms in other sections. The rural situation has been somewhat affected by the migration of the negro population to northern states, although this movement has not been as great in Texas as in some of the other southern states. The quality of the rural population has been affected by these changes.

It is difficult to determine the full effects of these social changes in rural community life. Reorganization and readjustment are certain to result from changes that are being made throughout the country. The readjustment in rural communities seems to involve a choice between "Roadville" and village life for rural dwellers. Social organizations in older civilizations have always tended toward the concentration of the farm population in village communities. There is a distinct tendency in that direction in this country at the present time. The question naturally arises, will history repeat itself in the United States? There is a possibility of averting this situation as a result of improved rural schools, the good roads movement, automobiles and trucks, radio, rural mail delivery, and rural telephones. These numerous inventions and improvements have largely removed the controlling influences of the past that resulted in urbanizing the farm population. It is possible that these conveniences and facilities will cause the farmers to build their homes along the hard-surfaced highways immediately accessible to the land they cultivate and convenient by automobile and truck to market centers. However, it is too early to determine definitely the influ-

ence that these improvements and inventions will exert on rural organization.

The growth of farm tenantry in Texas presents a problem of great importance. Many believe that the high percentage of tenants is entirely due to the large negro population. However, 177,198 of the white farmers, or 49.6 per cent, are tenants, while there are only 55,111 negro farm tenants. It is impossible to build a prosperous and progressive rural civilization with more than half the farmers cultivating the land on some basis of cash or share tenancy. The high percentage of tenancy in the large and populous counties of central and northern Texas is presenting social, economic and political problems that require the attention of the thoughtful citizenship of the State. The State will probably take cognizance of this situation and amend the constitution so as to give the legislature power to lend credit as an aid to tenant farmers in acquiring farm homes. State aid to tenant farmers has been advocated for some time. A modification of the California plan of aiding farmers to acquire homes of their own is under discussion, but a policy thoroughly adapted to Texas conditions will be necessary if it is to accomplish its purpose.

All things considered, the future of agriculture in Texas is most promising. The State has made marvelous progress in the development of its agricultural resources during the last decade. It is sure to make even greater progress in the future. All the problems of agricultural enterprise have not been solved,

nor have all the difficulties that confront the farmer been overcome; but some of the most important problems have been solved, or are in process of solution. The recognition that economic principles have important application to agricultural endeavor has been a long step forward. The increasing application of scientific principles to the productive processes of agriculture has improved plant varieties and increased the number and yields of economic plants. Texas farmers have manifested an increasing willingness to accept the conclusions of science as they relate to their endeavors.

The evidences of improved rural life conditions are to be seen on every hand. Improved highways are contributing to better market facilities and improved social advantages of the rural people. In every part of the State farmers are building better homes and supplying more conveniences for farm women. There has been great improvement in the cultivation of the soil, the rotation of crops and the marketing of farm products. All of these conditions have been brought about directly or indirectly through an improved financial system, the efforts of farmers to merchandise their products through cooperative marketing methods and the widespread dissemination of scientific knowledge by the Extension forces of the Agricultural and Mechanical College. The net result of all these influences will be the continued improvement of rural institutions and better and more wholesome rural life conditions.

STATISTICAL APPENDICES

Appendix A—Farms and Farm Property in Texas.

Appendix B—The Number, Total Value and Tenure of Farms in Texas by Counties.

Appendix C—Distribution of Population of Texas.

Appendix D—Urban and Rural Population by Counties in Texas.

Appendix E—Acreage and Production of Principal Farm Crops in Texas.

Appendix F—Live-Stock on Texas Farms by Counties.

Appendix G—Irrigation in Texas.

Appendix H—Mortgage Indebtedness of Texas Farms.

APPENDIX A

Farms and Farm Property in Texas

From the Fourteenth U. S. Census, 1920

Farms and Farm Acreage	*Jan. 1, 1920*	*April 15, 1910*
Number of farms.....	436,033	417,770
Operated by:		
Owners	201,210	195,863
Free from mortgage	105,490	128,082
Mortgage	69,940	64,008
No mortgage report	25,780	3,773
Managers	2,514	2,332
Tenants	232,309	219,575
Operated by:		
White farmers	357,249	347,852
Native	327,475	318,988
Foreign-born	29,774	28,864
Colored farmers	78,784	69,918
Land in farms:		
Total, acres	114,020,621	112,435,067
Improved, acres	31,227,503	27,360,666
Average acreage per farm:		
Total	261.5	269.1
Improved	71.6	65.5
Farm Values		
All farm property.....	$4,447,420,321	$2,218,645,164
Land and buildings..	3,700,173,319	1,843,208,395
Implements and machinery	154,320,996	56,790,260
Live-stock	592,926,006	318,646,509

APPENDIX A—(*Continued*)

Farm Values	*Jan. 1, 1920*	*April 15, 1910*
Average value per farm:		
All farm property....	10,200	5,311
Land and buildings...	8,486	4,412
Land alone	7,443	3,909
Average value per acre:		
Land and buildings..	32.45	16.39
Land alone	28.46	14.53
Mortgage Debt		
Farms reporting amount of debt:		
Number	57,700	48,024
Value	$ 664,522,579	$ 297,880,832
Amount of debt.....	172,166,818	76,089,272
Per cent of value....	25.9	25.5
Average rate of interest paid, per cent.....	7.3	....
Average debt per farm..	2,984	1,584

APPENDIX B

The Number, Total Value and Tenure of Farms in Texas by Counties

From the Fourteenth U. S. Census, 1920

Name of County	Number Farms	Total Value	How Operated By Owner	How Operated By Tenant
Anderson	4,399	$16,046,564	2,259	2,121
Angelina	1,985	5,527,497	1,397	586
Archer	760	20,993,120	427	310
Armstrong	373	12,445,590	213	143
Atascosa	1,534	15,931,954	677	843
Austin	3,139	20,321,939	1,723	1,410
Bandera	670	7,379,267	514	150
Bastrop	3,325	17,241,357	1,478	1,841
Baylor	811	14,177,907	396	400
Bee	1,497	20,318,212	506	982
Bell	4,555	53,682,894	1,815	2,732
Bexar	3,205	39,718,954	1,584	1,580
Blanco	713	8,816,145	481	228
Borden	197	5,987,083	113	79
Bosque	2,467	26,308,381	1,140	1,311
Bowie	4,970	17,386,448	2,146	2,810
Brazoria	2,074	17,544,228	1,070	991
Brazos	3,023	12,939,928	1,062	1,939
Brewster	163	11,286,387	126	27
Briscoe	397	11,073,663	234	161
Brooks	394	10,859,018	157	224
Brown	2,303	20,441,533	1,373	918
Burleson	2,685	14,910,724	1,206	1,462
Burnet	1,411	14,073,279	712	694
Caldwell	3,364	25,364,882	928	2,423
Calhoun	533	7,670,496	204	324
Callahan	1,649	15,890,770	809	823
Cameron	1,507	24,525,730	786	690
Camp	1,709	6,651,389	837	853
Carson	426	17,532,536	239	183
Cass	5,355	16,245,647	2,650	2,702

APPENDIX B—(*Continued*)

Name of County	Number Farms	Total Value	How Operated By Owner	How Operated By Tenant
Castro	365	12,265,393	242	116
Chambers	506	4,248,325	307	199
Cherokee	5,650	18,284,982	2,819	2,825
Childress	861	12,461,488	387	461
Clay	2,118	34,460,428	1,101	986
Coke	721	8,229,380	374	341
Coleman	2,330	23,935,347	1,042	1,276
Collin	6,001	84,669,765	1,891	4,109
Collingsworth	1,139	19,130,054	561	564
Colorado	2,469	20,031,776	1,273	1,188
Comal	807	10,924,823	575	225
Comanche	3,015	22,129,453	1,495	1,511
Concho	648	11,924,104	342	297
Cooke	2,919	35,139,234	1,513	1,390
Coryell	3,069	28,709,567	1,418	1,644
Cottle	686	12,380,084	349	333
Crosby	810	17,070,584	318	482
Dallam	218	15,877,794	123	70
Dallas	5,379	92,405,601	1,925	3,401
Dawson	574	11,303,320	378	195
Dewitt	3,376	37,244,405	1,471	1,891
Deaf Smith	382	17,676,052	223	142
Delta	2,191	28,066,510	703	1,487
Denton	4,200	55,916,524	1,828	2,354
Dickens	705	11,411,461	416	287
Dimmit	295	8,316,952	129	158
Donley	810	19,213,090	406	391
Duval	754	11,068,002	412	324
Eastland	1,499	9,549,718	837	654
Edwards	241	19,354,325	174	48
El Paso	542	8,726,633	312	203
Ellis	5,774	10,289,484	1,680	4,086
Erath	3,387	21,529,341	1,680	1,684
Falls	5,194	41,726,970	1,629	3,551
Fannin	6,338	65,217,645	2,184	4,148
Fayette	4,728	31,301,868	2,524	2,195
Fisher	1,541	18,794,691	790	743

APPENDIX B—(*Continued*)

Name of County	Number Farms	Total Value	How Operated By Owner	How Operated By Tenant
Floyd	1,289	30,595,455	712	572
Foard	629	11,359,877	331	290
Fort Bend	3,325	27,688,033	1,006	2,301
Franklin	1,844	9,128,074	799	1,042
Freestone	3,687	14,764,735	1,981	1,702
Frio	720	14,122,348	281	434
Gaines	140	8,234,373	103	25
Galveston	723	5,248,592	569	151
Garza	425	7,788,762	279	130
Gillespie	1,379	19,081,615	1,086	291
Glasscock	112	5,708,523	75	27
Goliad	1,407	14,868,914	511	884
Gonzales	4,361	32,341,036	1,525	2,800
Gray	580	17,685,052	360	208
Grayson	5,569	64,617,801	2,178	3,384
Gregg	1,812	7,056,678	1,273	2,234
Grimes	3,515	14,090,866	1,031	778
Guadalupe	4,188	37,077,855	1,509	2,664
Hale	1,031	80,426,028	601	415
Hall	1,051	16,830,061	468	575
Hamilton	2,049	17,782,779	1,166	881
Hansford	221	9,493,909	149	71
Hardeman	1,077	16,987,248	538	526
Hardin	376	1,156,255	322	53
Harris	2,880	23,967,760	1,850	999
Harrison	5,789	15,123,547	2,425	3,353
Hartley	139	12,250,167	78	43
Haskell	1,875	23,537,106	684	1,179
Hays	1,711	15,570,687	625	1,071
Hemphill	328	14,962,710	194	121
Henderson	4,423	18,867,679	2,243	2,178
Hidalgo	1,727	45,049,080	1,146	549
Hill	4,959	66,589,807	1,708	3,232
Hood	1,234	9,461,650	667	562
Hopkins	5,445	35,308,457	2,614	2,829
Houston	5,301	16,921,456	2,493	2,784
Howard	422	7,152,660	247	167

APPENDIX B—(*Continued*)

Name of County	Number Farms	Total Value	How Operated By Owner	How Operated By Tenant
Hunt	5,135	62,528,192	1,941	3,185
Hutchinson	134	7,486,101	95	35
Irion	136	7,468,814	96	37
Jack	1,463	14,076,865	868	578
Jasper	965	3,018,939	828	136
Jackson	1,485	18,897,188	540	938
Jefferson	419	7,161,621	231	172
Jim Wells	590	10,319,244	273	311
Johnson	3,367	40,329,098	1,450	1,885
Jones	2,586	26,305,718	1,095	1,475
Karnes	2,710	22,388,356	806	1,896
Kaufman	4,398	57,618,228	1,310	3,066
Kendall	617	8,917,183	492	115
Kent	412	7,297,356	208	201
Kerr	561	10,715,978	407	135
Kimble	372	12,895,440	277	79
Kleberg	273	8,208,699	110	157
Knox	1,037	13,459,535	436	594
La Salle	280	10,184,496	132	133
Lamar	6,831	56,804,901	2,191	4,623
Lamb	172	11,997,796	116	44
Lampasas	1,139	10,172,662	586	540
Lavaca	4,149	33,952,732	2,179	1,958
Lee	2,295	11,390,373	1,195	1,092
Leon	3,301	11,933,387	1,542	1,752
Liberty	1,314	8,108,525	1,017	294
Limestone	5,095	38,520,120	1,701	3,383
Lipscomb	483	14,315,225	314	163
Live Oak	572	14,406,359	299	266
Llano	686	14,751,504	438	240
Lubbock	1,009	19,272,251	549	447
Lynn	674	12,998,506	399	266
McCulloch	1,207	15,721,307	576	623
McLennan	5,709	64,590,649	1,924	3,750
McMullen	130	9,434,777	68	52
Madison	2,226	9,669,124	1,003	1,220
Marion	1,407	3,626,937	748	656

APPENDIX B—(*Continued*)

Name of County	Number Farms	Total Value	How Operated By Owner	How Operated By Tenant
Martin	139	3,874,946	95	44
Mason	764	17,836,549	508	242
Matagorda	1,616	17,861,147	600	1,002
Medina	1,198	20,115,310	700	488
Menard	308	11,808,872	181	117
Midland	133	13,307,236	86	47
Milam	5,606	35,452,805	1,771	3,821
Mills	1,464	11,301,959	747	715
Mitchell	864	11,069,177	446	416
Montague	3,005	19,501,006	1,722	1,278
Montgomery	1,932	6,401,575	1,029	900
Morris	1,745	6,568,502	624	1,120
Motley	537	15,368,934	252	281
Nacogdoches	4,219	14,899,074	2,210	2,002
Navarro	6,293	63,921,798	1,682	4,593
Newton	988	2,038,263	823	164
Nolan	1,015	11,113,695	475	528
Nueces	1,247	25,870,801	358	872
Ochiltree	336	13,069,125	207	123
Orange	311	3,644,242	247	60
Palo Pinto	1,242	16,268,966	662	564
Panola	3,771	12,464,770	1,822	1,943
Parker	2,945	21,591,203	1,664	1,266
Parmer	212	9,983,483	123	84
Pecos	207	18,689,667	146	50
Polk	2,022	5,596,174	1,273	744
Potter	166	11,120,786	97	58
Presidio	102	9,310,219	88	11
Rains	1,418	7,616,438	632	783
Real	260	3,984,385	176	76
Red River	5,832	34,128,288	2,040	3,784
Reeves	206	7,101,403	140	62
Refugio	310	8,256,423	108	190
Roberts	152	14,122,582	94	43
Robertson	4,903	17,747,020	1,945	2,940
Rockwall	1,075	19,055,149	302	771
Runnels	2,023	23,569,144	926	1,090

APPENDIX B—(*Continued*)

Name of County	Number Farms	Total Value	How Operated By Owner	How Operated By Tenant
Rusk	6,059	18,882,274	3,068	2,984
Sabine	1,270	3,407,688	814	455
San Augustine	1,606	3,919,600	884	722
San Jacinto	1,627	3,963,240	768	857
San Patricio	757	16,019,699	294	444
San Saba	1,268	15,249,276	762	501
Schleicher	225	14,243,471	150	60
Scurry	1,077	15,560,550	507	566
Shackelford	352	6,892,145	174	172
Shelby	4,240	12,368,003	2,389	1,837
Sherman	151	6,750,733	87	60
Smith	6,317	20,937,114	3,171	3,128
Somervell	530	3,213,591	328	301
Starr	559	2,609,182	465	93
Stephens	603	15,102,170	358	242
Sterling	131	6,501,043	88	36
Stonewall	575	7,774,897	283	200
Sutton	116	15,123,551	85	28
Swisher	572	17,665,817	317	245
Tarrant	3,336	46,270,626	1,655	1,641
Taylor	1,892	20,015,423	902	983
Terry	274	11,456,025	180	85
Throckmorton	500	10,564,321	330	159
Titus	2,938	12,788,006	1,239	1,696
Tom Green	680	16,344,079	369	291
Travis	3,469	39,202,786	1,253	2,186
Trinity	1,522	4,825,130	1,055	465
Tyler	1,134	3,669,902	851	278
Upshur	3,690	12,154,289	1,893	1,796
Uvalde	706	21,376,685	474	222
Val Verde	285	15,550,127	205	65
Van Zandt	5,149	27,793,142	2,776	2,368
Victoria	2,101	22,203,940	805	1,276
Walker	2,447	6,780,467	1,085	1,348
Waller	1,659	7,327,546	743	910
Ward	238	7,556,189	120	114
Washington	4,158	23,749,381	2,037	2,115

APPENDIX B—(*Continued*)

Name of County	*Number Farms*	*Total Value*	*How Operated* *By Owner*	*By Tenant*
Webb	257	12,195,432	145	74
Wharton	2,967	30,866,232	1,141	1,816
Wheeler	997	19,078,391	710	272
Wichita	750	15,248,813	261	476
Wilbarger	1,349	22,197,829	445	898
Williamson	4,508	63,734,206	1,853	2,737
Wilson	2,297	20,863,380	1,057	1,224
Wise	3,157	24,746,422	1,692	1,447
Wood	4,333	18,979,622	2,264	2,053
Yoakum	109	5,236,513	75	26
Young	1,480	19,658,719	833	637
Zapata	225	1,432,630	197	26
Zavalla	239	9,804,176	138	94

APPENDIX C

1. Distribution of the Population of Texas

From the Fourteenth U. S. Census, 1920

Class of Population	Number 1920	1910
Total population	4,663,228	3,896,542
White	3,918,165	3,204,848
Negro	741,694	690,049
Indian	2,109	702
Chinese	773	595
Japanese	449	340
All other	38 *	8
Native white, total	3,557,646	2,964,864
Native parentage	3,112,262	2,602,950
Foreign parentage	276,670	227,379
Mixed parentage	168,714	134,535
Foreign-born white	360,519	239,984
Urban population		
Total	1,512,689	938,104
White	1,288,187	758,534
Negro	223,373	178,864
Indian, Chinese, Japanese, and all other	1,129	706
Native white, total	1,120,137	672,443
Native parentage	951,006	558,214
Foreign parentage	103,278	68,530
Mixed parentage	65,853	45,699
Foreign-born white	168,050	86,091
Rural population		
Total	3,150,539	2,958,438
White	2,629,978	2,446,314
Negro	518,321	511,185
Indian, Chinese, Japanese, and all other	2,240	939

* Comprises 30 Filipinos, 4 Hindus, and 4 Koreans.

APPENDIX C—(*Continued*)

Class of Population	*Number* 1920	1910
Native white, total	2,437,509	2,292,421
Native parentage	2,161,256	2,044,736
Foreign parentage	173,392	158,849
Mixed parentage	102,861	88,836
Foreign-born white	192,469	153,893

2. Distribution of Population on the Basis of Number, Acreage and Value of Farms

Color and Nativity or Race	*Number of Farms*		*Land in Farms, 1920 (Acres)*		*Value of land and buildings, 1920*
	1920	*1910*	*Total*	*Improved*	
All farmers	436,033	417,770	114,020,621	31,227,503	$3,700,173,319
White farmers ...	357,249	347,852	109,561,481	28,066,949	3,474,000,091
Native	327,475	318,988	103,959,705	25,953,153	3,225,877,438
Foreign-born ...	29,774	28,864	5,601,776	2,113,796	248,122,653
Country of birth:					
Austria	3,535	5,236	424,549	232,505	28,890,307
Canada	200	234	130,080	16,471	3,124,568
Denmark	392	257	163,989	35,047	4,981,250
England	543	825	377,259	46,726	9,320,598
France	247	171	55,698	24,047	3,039,783
Germany	7,384	10,815	1,624,895	600,930	75,704,042
Ireland	184	317	103,616	15,694	3,057,020
Italy	906	710	226,391	42,221	4,440,284
Mexico	10,877	...	1,388,574	630,008	59,389,507
Norway	245	304	59,888	22,592	2,448,140

APPENDIX C—(*Continued*)

Color and Nativity or Race	Number of Farms		Land in Farms, 1920 (Acres)		Value of land and buildings,
	1920	1910	Total	Improved	1920
Poland	740	454	96,896	53,514	$ 4,480,443
Russia	389	257	159,349	48,098	4,608,128
Scotland	343	220	108,714	24,032	3,708,012
Sweden	869	1,026	143,755	99,324	11,554,750
Switzerland ..	406	321	91,675	40,471	5,392,610
Other countries	2,514	7,717	446,448	182,116	23,983,211
Colored farmers ..	78,784	69,918	4,459,140	3,160,554	226,173,228
Negro	78,597	69,816	4,438,379	3,148,038	224,864,322
Indian	153	52	8,103	5,817	429,906
Japanese	29	44	12,561	6,602	830,300
Chinese	5	6	97	97	48,700

APPENDIX C—(*Continued*)

3. Percentage Distribution of Farms and Farm Values on the Basis of Color

Color and Tenure	*Number of Farms*		*Value of Land and Buildings*	
	1920	*1910*	*1920*	*1910*
All farmers	100.0	100.0	100.0	100.0
Owners	46.1	46.9	52.8	56.1
Managers	0.6	0.6	5.6	8.5
Tenants	53.3	52.6	41.7	35.4
White	100.0	100.0	100.0	100.0
Owners	49.7	50.2	54.2	57.3
Managers	0.7	0.6	5.9	8.8
Tenants	49.6	49.2	39.9	33.9
Colored	100.0	100.0	100.0	100.0
Owners	29.9	30.4	30.1	33.5
Managers	0.2	0.1	1.3	1.2
Tenants	70.0	69.5	68.6	65.3

APPENDIX D

Urban and Rural Population by Counties in Texas

From the Fourteenth U. S. Census, 1920

Counties	Population 1920 Urban	Population 1920 Rural	Population 1910 Urban	Population 1910 Rural	Per cent of Increase in— Urban 1910-1920	Per cent of Increase in— Rural 1910-1920
The State	1,512,689	3,150,539	938,104	2,958,438	61.2	6.5
Anderson	11,039	23,279	10,482	19,168	5.3	21.4
Angelina	4,878	17,409	2,749	14,956	77.4	16.4
Bastrop	3,204	23,445	3,167	22,177	1.2	5.7
Bee	3,063	9,074	3,269	8,821	—6.3	2.9
Bell	16,131	30,281	15,157	34,029	6.4	—11.0 *
Bexar	161,379	40,717	96,614	23,062	67.0	76.6
Bowie	11,480	27,992	9,790	25,037	17.3	11.8
Brazos	6,307	15,668	4,132	14,787	52.6	6.0
Brown	8,223	13,459	6,967	15,968	18.0	—15.7
Caldwell	3,731	21,429	2,945	21,292	26.7	0.6
Cameron	16,861	19,801	10,517	16,641	60.3	19.0
Camp	2,540	8,563	.....	9,551	....	—10.3
Cherokee	3,723	33,910	2,875	26,163	29.5	29.6
Childress	5,003	5,930	3,818	5,720	31.0	3.7
Clay	2,563	14,301	.....	17,043	....	—16.1

* A minus sign (—) denotes decrease.

Coleman	2,868	15,937	3,046	19,572	— 5.8	— 18.6
Collin	6,677	42,932	4,714	44,307	41.6	— 3.1
Comal	3,590	5,234	3,165	5,269	13.4	— 0.7
Comanche	6,826	18,922	2,756	24,430	147.7	— 22.5
Cooke	8,648	17,019	7,624	18,979	13.4	— 10.3
Dallam	2,618	1,910	2,543	1,458	2.9	31.0
Dallas	158,976	51,575	92,104	43,644	72.6	18.2
DeWitt	5,984	21,987	4,902	18,599	22.1	18.2
Delta	2,563	13,324	.....	14,566	....	— 8.5
Denton	7,626	27,729	4,732	26,526	61.2	4.5
Eastland	39,203	19,302	.....	23,421	....	— 17.6
El Paso	77,560	24,317	39,279	13,320	97.5	82.6
Ellis	15,182	40,518	11,874	41,755	27.9	— 3.0
Erath	7,120	21,265	5,112	26,983	39.3	— 21.2
Falls	4,310	31,907	3,878	31,771	11.1	0.4
Fannin	8,650	39,536	4,844	39,957	78.6	— 1.1
Freestone	3,306	19,958	3,288	17,269	0.5	15.6
Galveston	46,764	6,386	36,981	7,498	26.5	— 14.8
Gonzales	3,128	25,310	3,139	24,916	— 0.4	1.6
Grayson	32,096	42,069	26,044	39,952	23.2	5.3
Gregg	5,713	11,054	5,155	8,985	10.8	23.0
Grimes	5,060	18,041	3,284	17,921	54.1	0.7
Guadalupe	3,631	24,088	3,116	21,797	16.5	10.5
Hale	3,989	6,115	2,829	4,737	41.0	29.1
Hall	2,839	8,298	.....	8,279	....	0.2
Hardeman	3,691	8,796	3,127	8,086	18.0	8.8

APPENDIX D—(*Continued*)

Counties	Population 1920 Urban	Population 1920 Rural	Population 1910 Urban	Population 1910 Rural	Per cent of Increase in— Urban 1910-1920	Per cent of Increase in— Rural 1910-1920
Hardin	3,032	12,951	.....	12,947	....	.... †
Harris	142,356	44,311	85,784	29,909	65.9	48.2
Harrison	14,271	29,294	11,452	25,791	24.6	13.6
Hartley	58	1,051	37	1,261	....	— 16.7
Hays	4,527	11,393	4,071	11,447	11.2	— 0.5
Henderson	3,576	25,151	.....	20,131	....	0.8
Hidalgo	12,592	25,518	.....	13,728	....	85.9
Hill	6,952	36,380	6,115	40,645	13.7	— 10.5
Hopkins	5,558	29,233	5,151	25,887	7.9	12.9
Houston	3,061	25,540	3,947	25,617	— 22.4	— 0.3
Howard	4,273	2,689	4,102	4,779	4.2	— 43.7
Hunt	16,226	34,124	11,668	36,448	39.1	— 6.4
Jefferson	62,673	10,447	28,303	9,879	121.4	5.7
Johnson	12,820	24,466	10,364	24,096	23.7	1.5
Jones	3,704	18,619	3,902	20,397	— 5.1	— 8.7
Kaufman	10,850	30,426	7,050	28,273	53.9	7.6
Kleberg	4,770	3,067	.....	.....	....	....
Lamar	15,040	40,702	11,269	35,275	33.5	15.4
Lavaca	3,871	25,093	2,864	23,554	35.2	6.5
Limestone	3,482	29,801	2,694	31,927	29.3	— 6.7
Lubbock	4,051	7,045	.....	3,624	....	94.4

† Less than one-tenth of one per cent.

APPENDIX D—(*Continued*)

McLennan	41,605	41,316	29,364	43,886	41.7	—5.9
Marion	2,549	8,337	2,515	7,957	1.4	4.8
Madagorda	3,454	13,135	3,156	10,438	9.4	25.8
Maverick	5,765	1,653	3,536	1,615	63.0	2.4
Milam	4,298	33,806	3,263	33,517	31.7	0.9
Montague	3,179	19,021	2,874	22,249	10.6	—14.5
Nacogdoches	3,546	24,911	3,369	24,037	5.3	3.6
Navarro	11,356	39,268	9,749	37,321	16.5	5.2
Nolan	4,307	6,561	4.176	7,823	3.1	—16.1
Nueces	10,522	12,285	8,222	13,733	28.0	—10.5
Orange	9,212	6.167	5,527	4,001	66.7	54.1
Palo Pinto	7,890	15,541	3,950	15,556	99.7	—0.1
Parker	6.203	17,179	5,074	21,257	23.2	—19.2
Potter	15,494	1,216	9,957	2,467	55.6	—50.7
Presidio	3,553	8,649	.....	5,218	....	65.8
Red River	3.386	32,443	.....	28,564	....	13.6
Robertson	2,741	25,192	2,579	24,875	6.3	1.3
Runnels	3,767	14,307	3,536	17,322	—21.7	—17.4
Smith	12,085	34,684	10,400	31,346	16.2	10.6
Tarrant	113,851	38,949	73,312	35,260	55.3	10.5
Taylor	10,274	13,807	9,204	17,089	11.6	—19.2
Titus	4,099	14,029	3,137	13,285	30.7	5.6
Tom Green	10,050	5,160	10,321	7,561	—2.6	—31.8
Travis	34,876	22,740	29,860	25,760	16.8	—11.7
Uvalde	3,885	6,884	3,998	7,235	—2.8	—4.9
Valverde	10,589	2,117	.....	8,613	....	—75.4

APPENDIX D—(*Continued*)

Counties	Population 1920 Urban	Population 1920 Rural	Population 1910 Urban	Population 1910 Rural	Per cent of Increase in— Urban 1910-1920	Per cent of Increase in— Rural 1910-1920
Victoria	5,967	12,314	3,673	11,317	62.2	8.8
Walker	4,689	13,867	.....	16,061	....	— 13.7
Washington	5,066	21,558	4,718	20,843	7.4	3.4
Webb	22,710	6,442	14,855	7,648	52.9	— 15.8
Wichita	50,123	22,788	8,200	7,894	511.3	188.7
Wilbarger	5,142	9,970	3,195	8,805	60.9	13.2
Williamson	8,836	34,098	8.410	33,818	5.1	0.8
Young	2,544	10,835	.....	13,657	....	— 20.7
All other counties ‡	.....	1,223,222	5,183	1,116,383	....	9.6

‡ Comprises all counties in which there were no incorporated places having twenty-five hundred inhabitants or more in 1920. These counties are Andrews, Aransas, Archer, Armstrong, Atascosa, Austin, Bailey, Bandera, Baylor, Blanco, Borden, Bosque, Brazoria, Brewster, Brisco, Brooks, Burleson, Burnett, Calhoun, Callahan, Carson, Cass, Castro, Chambers, Cochran, Coke, Collingsworth, Colorado, Concho, Coryell, Cottle, Crane, Crockett, Crosby, Culberson, Dawson, Deaf Smith, Dickens, Dimmit, Donley, Duval, Ector, Edwards, Fayette, Fisher, Floyd, Foard, Fort Bend, Franklin, Frio, Gaines, Garza, Gillespie, Glascock, Goliad, Gray, Hamilton, Hansford, Haskell, Hemphill, Hockley, Hood, Hudspeth, Hutchinson, Irion, Jack, Jackson, Jasper, Jeff Davis, Jim Hogg, Jim Wells, Karnes, Kendall, Kent, Kerr, Kimble, Kind, Kinney,

Knox, LaSalle, Lamb, Lampasas, Lee, Leon, Liberty, Lipscomb, Live Oak, Llano, Loving, Lynn, McCulloch, McMullen, Madison, Martin, Mason, Medina, Menard, Midland, Mills, Mitchell, Montgomery, Moore, Morris, Motley, Newton, Ochiltree, Oldham, Panola, Parmer, Pecos, Polk, Rains, Randall, Reagan, Real, Reeves, Refugio, Roberts, Rockwall, Rusk, Sabine, San Augustine, San Jacinto, San Patricio, San Saba, Schleicher, Scurry, Shackelford, Shelby, Sherman, Somervell, Starr, Stephens, Sterling, Stonewall, Sutton, Swisher, Terrell, Terry, Throckmorton, Trinity, Tyler, Upshur, Upton, Van Zandt, Waller, Ward, Wharton, Wheeler, Willacy, Wilson, Winkler, Wise, Wood, Yoakum, Zapata, and Zavalla.

APPENDIX E

Acreage and Production of Principal Farm

(Where no amount is given, no report

Name of County	Corn Acreage	Corn Bushels	Wheat Acreage
Anderson	59,163	927,438	140
Andrews	2,651	30,196	....
Angelina	22,906	268,423	....
Aransas	243	4,370	....
Archer	2,925	59,533	37,138
Armstrong	1,553	30,124	40,539
Atascosa	23,876	483,075	....
Austin	35,340	645,269	20
Bailey	818	21,250	20
Bandera	10,458	275,412	1,268
Bastrop	38,354	958,275	37
Baylor	5,485	136,224	38,132
Bee	21,561	493,077	....
Bell	57,783	2,228,993	33,789
Bexar	54,441	1,544,432	693
Blanco	9,514	294,331	2,306
Borden	574	8,097	150
Bosque	21,327	618,862	56,163
Bowie	56,458	817,547	112
Brazoria	34,273	489,134	....
Brazos	35,428	595,789	....
Brewster	340	7,051	150
Briscoe	2,085	34,065	13,919
Brooks	2,158	51,919	....
Brown	17,631	449,141	26,619
Burleson	30,765	648,509	67
Burnet	18,607	521,558	100,017
Caldwell	28,188	829,203	15
Calhoun	4,274	75,234	....
Callahan	10,223	187,537	21,716
Cameron	21,841	607,991	....
Camp	21,898	294,730	17
Carson	574	10,933	79,973

APPENDIX E

Crops: Fourteenth U. S. Census, 1920

from that county was given in the census.)

Wheat Bushels	*Cotton Acreage*	*Cotton Bales*	*Oats Acreage*	*Oats Bushels*
1,433	80,210	11,272	1,538	25,432
....	....	....	....	....
....	12,896	1,849	340	4,401
....	449	42	....	....
575,626	11,207	5,042	13,794	485,970
593,983	528	115	9,720	515,776
....	51,381	4,960	134	2,870
182	49,940	6,083	16	190
200	....	....	104	3,601
16,021	....	....	14,325	545,765
282	3,235	489	392	9,838
624,446	29,605	14,520	7,611	320,670
....	56,239	3,869	8	210
582,229	172,829	49,112	54,370	2,466,778
14,658	77,652	10,526	10,499	395,509
29,281	16,666	5,057	6,337	196,350
1,280	3,820	1,412	49	585
725,376	50,943	18,386	37,304	1,145,374
755	89,663	21,841	1,699	22,461
....	33,821	4,037	2	60
....	71,100	8,177	99	2,266
1,533	....	....	....	....
232,460	7,335	3,658	2,825	117,381
....	12,651	2,507	....	....
428,705	45,561	21,866	34,380	1,196,312
1,041	72,209	6,593	66	1,256
127,672	33,394	11,594	19,157	634,139
90	137,197	21,857	457	13,025
....	20,477	2,702	....	....
383,376	23,816	12,486	14,783	493,288
....	20,638	4,085	....	....
43	33,434	7,705	290	3,207
1,277,620	....	....	16,327	781,503

APPENDIX E—(*Continued*)

Name of County	*Corn Acreage*	*Corn Bushels*	*Wheat Acreage*
Cass	62,627	840,328	84
Castro	890	13,050	11,137
Chambers	2,746	36,016	....
Cherokee	67,374	1,106,908	40
Childress	3,699	77,608	19,149
Clay	21,196	509,736	51,596
Cochran	189	2,485	....
Coke	3,085	64,035	1,935
Coleman	6,924	189,484	26,081
Collin	73,258	2,574,689	63,261
Collingsworth	20,807	400,060	9,915
Colorado	28,052	557,950	2
Comal	14,942	439,182	992
Comanche	48,713	876,304	14,409
Concho	3,153	80,308	3,368
Cooke	28,848	766,278	53,441
Coryell	36,508	1,200,453	44,847
Cottle	4,697	95,656	11,435
Crockett	89	1,940	....
Crosby	2,772	71,458	15,316
Dallam	1,561	39,945	181
Dallas	49,151	1,639,816	40,239
Dawson	6,660	112,305	141
Dewitt	46,150	1,086,127	47
Deaf Smith	337	7,874	9,039
Delta	19,543	491,366	3,034
Denton	36,035	1,050,206	97,192
Dickens	3,518	86,949	1,775
Dimmit	2,769	62,872	....
Donley	9,810	208,761	5,377
Duval	7,290	120,572	....
Eastland	19,823	353,009	6,083
Ector	88	951	....
Edwards	1,601	43,447	100
El Paso	3,623	70,972	2,390
Ellis	52,822	1,929,095	33,956
Erath	42,957	936,040	19,228
Falls	51,613	1,832,792	2,520

APPENDIX E—(*Continued*)

Wheat Bushels	*Cotton Acreage*	*Cotton Bales*	*Oats Acreage*	*Oats Bushels*
930	93,784	19,638	1,120	15,676
136,150	10	2	3,688	149,934
....	328	96	....	....
480	84,907	12,792	2,202	25,225
321,678	51,485	20,456	2,410	87,231
731,926	59,044	21,552	26,602	911,764
....	....	....	....	....
25,260	28,183	11,270	10,152	275,471
451,317	82,853	41,808	40,854	1,651,713
950,360	176,901	49,311	47,048	1,647,100
129,357	49,553	25,572	1,038	45,385
29	41,288	6,247	43	1,093
15,458	21,542	3,920	5,295	127,160
221,920	50,084	17,710	31,842	911,484
48,237	34,355	15,814	9,121	228,326
642,731	74,129	25,536	34,439	1,124,636
811,555	78,338	28,852	43,179	1,513,018
212,853	45,416	22,694	1,686	59,909
....	50	4	100	2,375
242,630	35,130	17,127	2,105	68,194
3,258	....	....	222	4,706
584,399	150,302	37,020	41,421	1,448,541
1,710	24,249	9,447	19	279
965	112,709	8,688	65	903
152,103	....	....	2,945	111,295
37,964	76,364	26,654	9,047	273,144
1,295,742	115,257	33,175	46,093	1,458,795
29,845	35,494	17,492	651	23,477
....	4,978	1,402	33	990
75,904	18,240	10,211	1,817	73,726
....	30,737	7,133	....	....
100,195	23,632	12,037	10,264	274,956
....	363	54	....	....
1,491	135	48	62	2,031
33,370	1,548	1,036	1,969	37,303
518,820	298,729	65,192	42,859	1,447,249
251,124	63,865	19,738	35,684	925,943
37,592	188,383	37,974	15,345	568,268

APPENDIX E—(*Continued*)

Name of County	*Corn Acreage*	*Corn Bushels*	*Wheat Acreage*
Fannin	81,578	2,385,755	22,259
Fayette	59,448	1,480,253	34
Fisher	3,504	72,785	16,959
Floyd	2,971	54,191	49,104
Foard	2,615	56,197	47,699
Fort Bend	36,088	696,551	....
Franklin	18,244	314,726	150
Freestone	47,342	907,490	169
Frio	14,757	295,504	....
Gaines	3,762	39,458	....
Galveston	3,885	47,857	....
Garza	1,389	24,882	1,366
Gillespie	16,206	476,168	6,764
Glasscock	212	3,185	233
Goliad	22,542	459,528	....
Gonzales	53,009	1,300,816	....
Gray	1,781	66,959	25,102
Grayson	56,597	1,910,090	52,087
Gregg	21,328	346,481	5
Grimes	37,714	540,024	88
Guadalupe	56,337	1,796,917	46
Hale	3,363	55,667	57,954
Hall	3,786	73,213	3,037
Hamilton	23,949	752,567	27,302
Hansford	174	1,910	32,496
Hardeman	5,677	108,477	51,886
Hardin	2,895	41,050	....
Harris	22,109	324,203	....
Harrison	63,345	877,114	3
Hartley	744	18,607	796
Haskell	5,457	112,367	60,302
Hays	18,005	526,446	297
Hemphill	9,172	222,356	9,306
Henderson	56,373	1,033,862	314
Hidalgo	23,162	721,091	....
Hill	56,862	1,918,110	30,257
Hockley	294	5,334	....
Hood	16,569	345,724	11,795

APPENDIX E—(*Continued*)

Wheat *Bushels*	*Cotton* *Acreage*	*Cotton* *Bales*	*Oats* *Acreage*	*Oats* *Bushels*
301,643	189,215	65,154	40,438	1,285,809
528	100,414	11,954	159	2,355
241,861	82,499	43,152	7,592	206,216
962,272	27,180	13,078	7,150	391,039
941,670	17,038	9,143	3,178	137,670
....	80,800	11,160	....	....
1,256	36,625	10,318	3,001	42,640
2,466	99,713	17,264	2,938	71,148
....	55,349	4,308	....	....
....	485	97	....	....
....	2,137	235	....	....
16,421	18,358	8,706	559	18,995
114,782	33,185	10,473	14,405	626,177
3,325	1,055	241	....	....
....	50,825	3,070	....	....
....	146,426	9,046	152	1,242
537,588	324	127	13	130
763,646	144,214	49,520	77,736	2,756,244
20	35,717	7,605	695	10,571
1,220	73,106	8,477	261	8,663
589	154,071	23,085	1,054	39,997
926,167	6,630	2,079	5,477	252,393
54,176	65,333	36,773	899	32,551
338,325	42,198	17,459	50,541	1,658,397
476,054	....	....	3,328	124,018
871,134	37,444	19,347	3,075	101,479
....	582	95	1	12
....	10,387	1,801	30	1,500
32	100,034	17,439	485	6,120
10,277	....	....	439	9,787
835,024	85,576	40,381	13,306	466,329
2,887	60,516	12,055	2,508	67,160
102,897	285	122	3,295	127,212
3,366	88,105	19,255	2,205	56,153
....	21,303	7,124	25	900
423,837	220,844	52,649	45,638	1,309,502
....	87	29	....	....
121,946	25,404	8,100	8,293	205,622

APPENDIX E—(*Continued*)

Name of County	Corn Acreage	Corn Bushels	Wheat Acreage
Hopkins	54,291	1,106,659	3,290
Houston	61,591	921,591	216
Howard	2,275	35,129	1,168
Hudspeth	26	650	30
Hunt	50,310	1,435,159	17,525
Hutchinson	205	3,735	8,399
Irion	301	7,084	69
Jack	12,391	249,643	21,728
Jackson	12,675	172,930	....
Jasper	10,425	133,197	....
Jeff Davis	97	1,099	....
Jefferson	2,883	26,101	20
Jim Hogg	485	5,398	....
Jim Wells	7,880	185,260	....
Johnson	35,042	1,152,473	22,410
Jones	4,111	86,173	32,885
Karnes	36,568	944,775	....
Kaufman	34,189	929,196	11,064
Kendall	7,917	239,223	4,798
Kerr	5,211	155,811	7,338
Kent	3,227	60,978	389
Kimble	3,017	86,085	936
King	541	12,825	527
Kinney	1,724	71,732	60
Kleberg	2,016	53,295	....
Knox	7,120	163,835	32,340
La Salle	4,214	100,221	....
Lamar	82,331	1,886,312	3,199
Lamb	744	19,340	2,551
Lampasas	14,899	432,853	7,583
Lavaca	47,782	1,068,922	6
Lee	28,922	585,618	31
Leon	48,258	799,300	336
Liberty	11,877	135,713	3
Limestone	51,821	1,538,053	3,331
Lipscomb	3,012	42,091	30,569
Live Oak	8,826	210,710	....
Llano	8,954	170,620	269

APPENDIX E—(*Continued*)

Wheat Bushels	*Cotton Acreage*	*Cotton Bales*	*Oats Acreage*	*Oats Bushels*
38,440	128,403	35,237	27,181	780,581
1,534	83,239	10,786	1,440	28,080
8,816	24,875	7,349	318	4,795
417	....	....	....	....
271,352	187,881	54,398	48,904	1,563,358
139,135	....	....	1,472	77,666
1,312	2,040	632	438	13,240
351,819	21,144	6,029	13,734	498,250
....	35,606	3,442	20	1,100
....	2,251	240	165	1,323
....	....	....	....	....
35	26	7	10	80
....	2,253	411	....	....
....	13,844	2,426	....	....
298,347	124,751	39,334	28,144	1,031,376
499,057	124,871	66,543	18,035	698,182
....	132,308	10,336	65	1,592
175,405	202,662	57,263	29,296	995,293
81,668	3,957	1,052	13,165	588,799
129,388	3,315	724	12,705	608,091
4,076	19,410	8,727	628	11,168
14,124	4,507	1,920	1,288	41,697
6,065	2,594	1,209	139	4,405
720	553	81	366	11,333
....	9,545	2,065	208	8,758
558,009	53,645	25,666	6,479	271,901
....	17,753	4,263	....	....
36,448	200,364	69,264	11,857	345,073
21,177	395	95	372	11,196
88,556	24,046	8,706	19,690	564,558
102	97,416	7,021	44	338
183	52,433	5,175	105	3,250
6,711	67,008	10,912	1,358	27,071
6	2,667	424	20	176
50,601	213,662	38,047	18,138	552,651
349,181	....	....	3,870	116,503
....	16,596	1,359	107	4,280
2,481	10,488	3,320	2,019	52,583

APPENDIX E—(*Continued*)

Name of County	*Corn Acreage*	*Corn Bushels*	*Wheat Acreage*
Lubbock	5,570	153,282	1,783
Lynn	4,521	111,724	1,624
McCulloch	7,508	213,132	5,160
McLennan	58,420	1,878,021	27,392
McMullen	1,729	37,606	....
Madison	39,252	589,202	29
Marion	13,501	175,713	28
Martin	410	4,771	....
Mason	9,587	186,919	875
Matagorda	93,874	353,623	....
Maverick	1,337	14,599	505
Medina	44,061	1,191,141	214
Menard	2,467	57,230	1,462
Midland	83	948	....
Milam	67,455	2,041,394	1,650
Mills	13,380	381,754	8,591
Mitchell	3,440	60,798	709
Montague	39,875	877,014	11,560
Montgomery	15,242	139,147	....
Moore	569	10,085	2,733
Morris	20,131	328,910	9
Motley	4,546	83,378	2,230
Nacogdoches	55,925	835,912	15
Navarro	61,814	1,832,667	10,880
Newton	9,701	106,732	6
Nolan	1,900	43,591	4,366
Nueces	10,840	298,639	....
Ochiltree	1,117	13,070	41,742
Oldham	65	2,182	7,099
Orange	1,773	24,083	....
Palo Pinto	15,011	303,774	13,419
Panola	49,129	797,601	....
Parker	33,611	647,922	27,404
Parmer	1,299	35,394	5,370
Pecos	85	1,215	73
Polk	17,124	195,227	3
Potter	138	2,522	16,352
Presidio	697	12,704	1,019

APPENDIX E—(*Continued*)

Wheat Bushels	*Cotton Acreage*	*Cotton Bales*	*Oats Acreage*	*Oats Bushels*
20,531	35,746	17,603	520	20,255
18,654	23,085	9,969	624	15,041
104,343	57,332	23,968	19,723	622,414
452,736	234,730	54,655	66,847	2,553,221
....	1,828	265	....	....
397	40,249	6,212	302	4,506
400	23,932	4,917	332	4,985
....	6,659	1,340	....	....
9,235	15,858	4,680	3,905	115,341
....	46,257	4,221	70	2,403
3,980	....	....	53	1,415
2,932	32,196	2,601	13,934	523,319
22,561	5,538	2,198	1,983	56,228
....	4,626	951	....	....
21,097	195,356	46,894	7,597	293,754
103,706	28,560	1,640	27,786	765,765
6,449	45,712	20,665	764	11,855
159,252	75,746	25,991	14,638	486,096
....	15,760	1,542	46	1,150
42,933	....	....	1,081	39,230
74	34,499	8,394	590	7,741
40,095	21,574	11,071	895	42,810
83	58,589	7,665	1,631	19,392
153,883	261,059	44,304	37,244	1,003,295
50	1,406	222	237	2,895
54,300	35,875	18,124	4,181	110,903
....	118,928	21,001	....	....
563,758	....	....	3,796	149,228
114,149	....	....	1,966	75,474
....	27	12	2	10
206,875	20,331	7,832	10,572	312,248
....	67,629	7,844	1,837	24,733
273,974	47,501	14,356	13,069	347,786
78,124	....	....	697	28,907
1,660	7,871	2,832	166	4,538
45	13,090	1,945	193	3,044
256,170	....	....	4,668	193,999
8,617	12	4	....	....

APPENDIX E—(*Continued*)

Name of County	*Corn Acreage*	*Corn Bushels*	*Wheat Acreage*
Rains	16,168	349,598	950
Randall	304	4,690	40,245
Reagan	73	1,246	....
Real	2,806	78,034	41
Red River	67,520	1,870,692	331
Reeves	125	1,575	412
Refugio	3,794	95,306	....
Roberts	517	11,307	29,350
Robertson	58,327	1,085,479	191
Rockwall	11,226	378,929	3,995
Runnels	3,626	94,334	24,405
Rusk	76,367	1,089,361	41
Sabine	14,842	182,567	2
San Augustine	20,174	244,586	....
San Jacinto	15,005	162,270	....
San Patricio	5,901	139,584	....
San Saba	13,225	346,156	3,264
Schleicher	836	20,665	241
Scurry	2,997	51,417	6,008
Shackelford	502	13,228	9,099
Shelby	54,517	765,470	....
Sherman	385	8,159	7,589
Smith	72,337	1,087,555	180
Somervell	7,079	146,909	4,921
Starr	5,447	67,850	....
Stephens	3,854	76,145	13,543
Sterling	304	6,527	20
Stonewall	3,059	50,723	8,754
Sutton	421	10,879	26
Swisher	1,314	19,737	59,806
Tarrant	32,029	892,554	41,205
Taylor	3,018	71,688	34,312
Terry	10,009	173,420	80
Throckmorton	2,626	63,485	18,763
Titus	37,097	639,709	275
Tom Green	1,600	38,204	4,280
Travis	41,106	1,331,186	1,189
Trinity	16,119	187,874	....

APPENDIX E—(*Continued*)

Wheat Bushels	*Cotton Acreage*	*Cotton Bales*	*Oats Acreage*	*Oats Bushels*
15,510	31,432	8,291	6,020	174,964
603,042	....	....	8,028	348,241
....	5	5	16	300
551	174	54	550	18,965
4,625	135,272	46,263	4,198	80,618
6,196	4,666	1,846	109	1,705
....	24,988	5,047	....	....
545,484	....	....	3,263	141,365
2,597	120,346	16,564	1,397	25,283
58,342	42,024	9,788	6,638	273,941
422,996	86,976	43,660	35,669	1,201,876
834	99,321	13,320	1,937	26,616
15	7,559	879	180	2,557
....	15,330	1,988	233	2,247
....	12,970	1,770	18	114
....	60,079	11,639	....	....
39,782	38,034	13,771	12,912	418,767
3,534	4,362	1,366	1,739	46,415
64,206	42,275	18,981	1,530	27,015
166,982	13,426	6,501	6,352	247,821
....	61,269	7,306	1,604	19,866
112,725	....	....	2,281	84,266
1,630	119,766	19,615	1,720	22,791
47,162	10,610	3,083	3,414	86,965
....	9,697	1,966	....	....
198,900	3,375	1,479	11,419	328,678
280	649	166	....	....
117,711	28,624	13,283	1,390	42,038
645	409	110	450	20,734
791,271	103	36	10,144	439,484
463,466	72,444	18,020	28,195	891,004
638,097	70,952	38,180	23,263	807,257
1,600	3,763	1,437	....	....
375,359	15,329	7,070	6,521	268,417
2,235	53,578	15,606	2,488	51,107
55,606	25,371	11,182	8,257	171,689
14,330	142,273	36,704	9,523	317,130
....	11,539	1,507	123	1,568

APPENDIX E—(*Continued*)

Name of County	*Corn Acreage*	*Corn Bushels*	*Wheat Acreage*
Tyler	11,937	137,421	2
Upshur	40,206	1,061,823	64
Uvalde	12,843	420,946	103
Val Verde	1,681	34,423	16
Van Zandt	60,203	1,106,610	3,297
Victoria	24,477	455,520	....
Walker	19,017	100,888	....
Waller	21,844	340,448	....
Ward	....	....	....
Washington	45,596	942,586	....
Webb	2,468	40,333	....
Wharton	34,558	679,214	....
Wheeler	29,863	647,073	11,639
Wichita	7,813	173,099	683,336
Wilbarger	20,112	443,943	45,976
Williamson	58,255	2,243,826	11,531
Wilson	37,445	839,687	....
Wise	42,063	894,912	29,569
Wood	58,841	1,033,231	199
Yoakum	2,153	23,590	....
Young	12,299	271,899	42,293
Zapata	2,521	31,324	....
Zavalla	3,360	91,272	....

Total Annual Yield of

From the Yearbook of the U. S.

Crop	*1920*	*Thousands of 1921*
Corn	5,487	6,227
Cotton	11,898	10,745
Oats	1,490	1,865
Wheat	1,583	2,081

* Bales of 500 pounds each.

APPENDIX E—(*Continued*)

Wheat Bushels	*Cotton Acreage*	*Cotton Bales*	*Oats Acreage*	*Oats Bushels*
32	1,978	303	157	1,946
250	70,765	14,645	1,482	14,275
1,500	22,594	2,152	17,851	782,668
469	....	....	1,841	48,332
40,648	124,021	29,865	17,337	531,682
....	61,661	7,031	33	255
....	23,095	2,639	21	490
....	23,347	2,300	20	175
....	10,136	4,095	....	....
....	98,012	11,014	89	1,535
....	7,992	2,501	....	....
....	58,090	8,326	....	....
142,973	12,418	5,499	1,381	66,758
880,011	10,661	4,901	11,643	363,250
793,338	64,871	30,450	7,749	310,890
207,250	226,979	77,733	31,887	1,325,097
....	102,119	11,508	105	3,154
351,338	66,368	19,341	15,530	474,830
1,808	80,350	18,187	1,529	25,283
....	47	7	....	....
733,365	33,641	15,126	19,493	780,497
....	2,300	599	....	....
....	5,763	1,452	1,244	41,899

Leading Staple Crops

Department of Agriculture (1922)

Acres		*Production (Thousands of bushels)*	
1922	*1920*	*1921*	*1922*
5,729	142,662	156,920	114,580
12,125	4,345 *	2,198 *	3,290 *
1,455	32,780	33,570	33,465
1,249	20,579	20,810	9,992

APPENDIX F

Live-Stock on Texas Farms by Counties

From the Fourteenth U. S. Census, 1920

Counties	Number of Beef Cattle	Number of Dairy Cows	Number of Sheep and Goats	Number of Swine
Anderson	7,483	14,107	966	33,111
Andrews	14,308	25	284	260
Angelina	7,809	5,825	4,809	27,264
Aransas	8,718	484	519	702
Archer	40,122	2,374	1,866	2,906
Armstrong	21,859	837	2,829	2,849
Atascosa	19,877	5,794	2,050	9,473
Austin	27,453	13,533	1,624	17,009
Bailey	16,173	225	4,879	1,213
Bandera	7,550	1,805	100,419	7,113
Bastrop	10,517	11,120	1,679	16,810
Baylor	22,188	11,159	125	3,286
Bee	57,395	5,095	3,941	9,049
Bell	3,945	15,271	9,892	17,535
Bexar	16,671	22,596	11,219	13,604
Blanco	17,226	1,389	23,465	4,876
Borden	17,525	655	4,740	872
Bosque	16,002	12,053	14,930	7,625
Bowie	4,042	13,807	1,263	17,605
Brazoria	29,074	8,070	1,842	10,067
Brazos	11,765	7,969	2,810	14,413
Brewster	57,261	282	19,368	294
Briscoe	24,028	549	4,778	6,681
Brooks	33,066	3,375	1,120	1,309
Brown	21,204	9,568	14,512	10,148
Burleson	11,265	6,791	1,535	14,794
Burnet	16,910	7,934	50,596	7,392
Caldwell	3,672	6,435	748	10,351
Calhoun	12,207	2,615	1,904	2,009
Callahan	13,056	7,143	6,019	6,710
Cameron	9,768	5,501	6,825	6,583

APPENDIX F—(*Continued*)

Counties	*Number of Beef Cattle*	*Number of Dairy Cows*	*Number of Sheep and Goats*	*Number of Swine*
Camp	740	6,590	19	6,348
Carson	27,999	375	1,179	3,634
Cass	1,568	17,425	2,031	17,716
Castro	30,989	466	5,637	4,658
Chambers	18,693	493	794	3,166
Cherokee	7,986	18,273	2,003	23,038
Childress	8,793	3,088	625	5,652
Clay	43,874	9,854	3,141	6,334
Cochran	21,513	9	....	130
Coke	16,435	2,581	16,093	1,980
Coleman	10,930	7,845	45,448	6,615
Collin	1,412	14,358	7,131	24,559
Collingsworth	28,687	3,715	1,946	11,787
Colorado	39,068	9,543	2,422	15,416
Comal	16,281	2,636	6,698	4,435
Comanche	5,862	13,414	5,539	14,072
Concho	18,828	3,064	46,050	3,105
Cooke	13,530	13,209	3,712	13,107
Coryell	11,266	12,306	10,404	11,632
Cottle	18,803	3,079	154	3,952
Crane	4,718	....	....	147
Crockett	62,883	36	192,174	1,335
Crosby	12,090	2,698	5,400	6,197
Culberson	48,951	23	11,741	28
Dallam	37,444	1,313	12	1,863
Dallas	6,480	21,038	13,323	24,621
Dawson	16,936	1,758	3,546	2,267
DeWitt	38,253	12,229	6,070	20,880
Deaf Smith	38,881	1,766	7,382	4,253
Delta	326	4,757	256	5,732
Denton	12,823	14,326	22,975	17,239
Dickens	18,340	2,442	3,156	2,822
Dimmit	31,238	1,367	17,841	1,661
Donley	28,074	3,482	383	6,420
Duval	20,667	2,297	7,965	1,580
Eastland	5,644	5,441	2,491	6,568

APPENDIX F—(*Continued*)

Counties	*Number of Beef Cattle*	*Number of Dairy Cows*	*Number of Sheep and Goats*	*Number of Swine*
Ector	11,000	60	164	173
Edwards	28,694	434	509,932	4,943
El Paso	1,989	3,588	4,617	2,998
Ellis	2,249	13,249	3,782	21,695
Erath	15,398	14,087	5,063	8,914
Falls	6,355	12,155	1,260	20,254
Fannin	2,977	14,665	537	22,772
Fayette	15,212	27,108	1,669	27,497
Fisher	13,155	6,030	2,388	3,900
Floyd	18,068	5,434	4,550	11,271
Foard	12,740	2,291	1,912	2,550
Fort Bend	24,430	7,954	2,856	11,980
Franklin	3,411	5,819	613	5,721
Freestone	9,344	8,733	2,448	21,479
Frio	29,962	3,210	8,244	4,635
Gaines	31,485	568	1,082	653
Galveston	8,037	7,034	683	1,876
Garza	17,990	1,555	700	2,066
Gillespie	25,213	2,922	95,745	11,452
Glasscock	17,806	127	10,126	335
Goliad	21,229	3,921	3,567	9,892
Gonzales	26,017	16,369	4,739	22,138
Gray	33,067	1,723	345	4,561
Grayson	3,390	18,969	1,842	20,506
Gregg	2,145	5,584	321	8,765
Grimes	27,285	6,893	2,206	12,972
Guadalupe	6,906	9,557	438	15,094
Hale	20,175	5,658	17,670	14,175
Hall	15,304	3,500	20	6,839
Hamilton	13,240	7,374	12,125	7,486
Hansford	15,968	982	3	2,056
Hardeman	13,103	4,415	54	5,566
Hardin	4,410	1,006	3,356	11,771
Harris	34,758	18,298	19,180	18,802
Harrison	5,102	16,248	1,700	20,185
Hartley	42,023	251	237	1,233

APPENDIX F—(*Continued*)

Counties	*Number of Beef Cattle*	*Number of Dairy Cows*	*Number of Sheep and Goats*	*Number of Swine*
Haskell	12,761	5,122	1,563	5,925
Hays	9,398	5,717	6,822	6,010
Hemphill	53,903	1,143	104	5,372
Henderson	7,095	12,377	1,109	31,807
Hidalgo	13,432	5,802	8,790	7,469
Hill	3,313	15,646	4,384	20,527
Hockley	21,209	55	205	172
Hood	6,202	5,671	3,100	6,119
Hopkins	4,619	18,460	1,257	15,090
Houston	18,801	10,457	3,762	29,258
Howard	9,660	2,405	11,906	1,496
Hudspeth	23,865	8	1,435	6
Hunt	4,459	12,701	2,124	17,298
Hutchinson	25,147	38	32	792
Irion	27,104	318	85,323	541
Jack	30,866	4,613	4,522	5,786
Jackson	43,151	6,273	1,727	7,083
Jasper	12,041	916	6,244	17,368
Jeff Davis	41,769	315	....	279
Jefferson	11,130	2,151	598	3,801
Jim Hogg	6,132	164	1,568	93
Jim Wells	23,570	5,418	4,803	3,044
Johnson	5,554	10,775	3,994	9,801
Jones	6,131	9,220	897	7,602
Karnes	18,646	5,732	2,067	11,833
Kaufman	2,412	12,264	3,444	15,370
Kendall	11,840	3,661	22,730	2,922
Kent	16,756	588	1,324	1,821
Kerr	16,111	2,676	109,508	8,010
Kimble	14,419	776	299,305	4,003
King	9,541	153	37	558
Kinney	12,691	634	71,625	780
Kleberg	34,512	2,733	3,477	1,869
Knox	7,837	3,687	63	4,123
LaSalle	37,139	1,712	13,959	1,659
Lamar	3,539	16,526	812	21,920

APPENDIX F—(*Continued*)

Counties	*Number of Beef Cattle*	*Number of Dairy Cows*	*Number of Sheep and Goats*	*Number of Swine*
Lamb	26,892	1,114	1,857	2,146
Lampasas	11,174	4,722	45,571	4,481
Lavaca	27,683	23,743	4,352	24,982
Lee	6,787	14,727	1,624	16,934
Leon	12,356	8,644	4,258	30,300
Liberty	32,372	4,763	6,386	20,143
Limestone	6,266	12,970	1,967	21,057
Lipscomb	41,301	2,076	2,199	4,814
Live Oak	32,018	2,693	4,068	5,088
Llano	58,806	2,207	18,591	19,389
Loving	2,799	6	1	16
Lubbock	16,562	4,444	20,310	7,249
Lynn	14,637	2,872	1,435	3,957
McCulloch	20,735	4,975	29,519	6,155
McLennan	5,353	17,459	12,188	18,549
McMullen	41,948	919	6,639	1,479
Madison	11,804	6,806	3,177	10,690
Marion	1,163	5,045	511	6,590
Martin	13,662	293	2	384
Mason	42,735	494	34,032	16,871
Matagorda	49,904	6,043	1,344	7,744
Maverick	7,385	256	2,830	741
Medina	27,882	4,485	10,623	8,580
Menard	27,224	509	107,174	5,630
Midland	54,484	298	36	488
Milam	10,931	14,415	2,820	29,774
Mills	12,743	6,464	26,814	6,146
Mitchell	14,858	3,064	3,625	3,229
Montague	15,866	13,244	1,053	9,962
Montgomery	20,427	2,670	5,223	15,548
Moore	14,917	21	1,297	946
Morris	1,955	4,711	455	6,709
Motley	45,011	1,934	480	3,880
Nacogdoches	6,705	18,826	2,917	25,082
Navarro	6,467	13,884	4,137	18,965
Newton	10,085	1,541	5,985	10,145

APPENDIX F—(*Continued*)

Counties	*Number of Beef Cattle*	*Number of Dairy Cows*	*Number of Sheep and Goats*	*Number of Swine*
Nolan	10,476	3,064	18,712	3,881
Nueces	12,680	7,773	1,028	5,342
Ochiltree	22,942	987	917	4,708
Oldham	22,876	224	34	661
Orange	8,500	1,179	3,703	6,869
Palo Pinto	27,096	5,248	2,643	5,203
Panola	9,176	11,086	2,401	26,900
Parker	7,204	14,343	3,643	10,747
Parmer	19,402	417	9,418	2,088
Pecos	77,082	415	91,889	510
Polk	12,321	4,299	5,643	29,436
Potter	35,146	1,192	4,918	1,390
Presidio	37,565	1,923	12,439	365
Rains	829	4,707	220	5,187
Randall	28,369	1,925	1,684	4,176
Reagan	16,735	130	47,968	145
Real	5,643	1,034	121,401	4,991
Red River	7,993	14,705	1,384	25,073
Reeves	36,761	365	2,916	243
Refugio	14,647	1,096	779	2,167
Roberts	35,491	87	164	1,336
Robertson	12,972	7,735	2,728	25,957
Rockwall	187	2,090	592	4,045
Runnels	7,745	7,684	26,395	6,885
Rusk	5,305	22,367	1,794	27,188
Sabine	4,536	5,739	4,037	15,460
San Augustine	2,814	7,563	3,893	14,507
San Jacinto	12,624	1,029	4,335	12,011
San Patricio	12,401	4,083	788	3,662
San Saba	36,689	5,124	27,283	10,247
Schleicher	46,288	344	140,006	2,959
Scurry	11,368	3,065	3,090	3,826
Shackelford	12,805	1,200	653	1,071
Shelby	8,004	14,526	2,638	30,359
Sherman	20,074	188	....	1,499
Smith	3,476	20,756	597	23,419

APPENDIX F—(*Continued*)

Counties	*Number of Beef Cattle*	*Number of Dairy Cows*	*Number of Sheep and Goats*	*Number of Swine*
Somervell	1,073	2,788	890	2,649
Starr	7,781	230	20,371	670
Stephens	15,843	2,432	760	1,986
Sterling	17,266	102	67,100	434
Stonewall	11,260	1,655	21,496	1,598
Sutton	44,418	128	291,903	1,889
Swisher	23,980	2,284	1,678	4,518
Tarrant	13,198	15,893	5,755	13,654
Taylor	7,714	6,975	2,250	5,334
Terrell	31,292	89	145,574	152
Terry	25,563	735	511	2,082
Throckmorton	27,488	688	484	1,721
Titus	2,579	8,814	649	10,116
Tom Green	38,429	2,494	85,469	3,441
Travis	8,241	12,014	7,932	14,768
Trinity	13,127	6,380	4,845	20,697
Tyler	12,082	1,613	7,274	23,619
Upshur	2,571	12,203	669	12,709
Upton	19,347	39	24,670	71
Uvalde	59,381	2,842	82,816	6,768
Val Verde	28,535	993	391,474	1,359
Van Zandt	6,499	16,550	782	19,628
Victoria	51,898	7,704	3,942	8,988
Walker	10,464	8,795	1,437	11,015
Waller	16,754	2,145	1,322	8,125
Ward	9,470	256	6	294
Washington	18,251	11,981	1,494	20,936
Webb	47,134	1,090	13,544	1,026
Wharton	23,543	11,272	1,392	15,660
Wheeler	31,389	2,070	472	13,310
Wichita	11,828	4,578	29	3,260
Wilbarger	4,476	5,584	385	7,850
Willacy	14,210	136	113	249
Williamson	6,881	17,373	20,578	20,603
Wilson	9,850	10,555	462	12,070
Winkler	12,638	....	40	104

APPENDIX F—(*Continued*)

Counties	*Number of Beef Cattle*	*Number of Dairy Cows*	*Number of Sheep and Goats*	*Number of Swine*
Wise	17,291	11,924	4,254	12,739
Wood	2,881	14,893	470	16,364
Yoakum	21,075	38	2,509	446
Young	28,068	4,637	6,064	7,720
Zapata	6,849	39	1,682	295
Zavalla	38,496	1,307	1,626	1,921

APPENDIX G

Irrigation in Texas

Summarized from the Fourteenth U. S. Census, 1920

Item	Census of—		Increase	
	1920	1910	Amount	Per cent
Number of farms irrigated	5,974	5,238	736	14.1
Area irrigated, acres	586,120	451,130	134,990	29.9
Area enterprises were capable of irrigating	1,550,542	690,991	459,551	66.5
Area included in enterprises, acres	1,687,447	1,253,173	434,274	34.7
Per cent irrigated:				
Number of all farms	1.4	1.3	0.1	....
Approximate land area of the state	0.3	0.3	...	....
Land in farms	0.5	0.4	0.1	....
Improved land in farms	1.9	1.6	0.3	....
Excess of area enterprises were capable of irrigating over area irrigated, acres	564,422	239,861	324,561	135.3
Excess of area included in enterprise over area irrigated, acres	1,101,327	802,043	299,284	37.3
Area of irrigated land reported as available for settlement	346,446	*	.....	....

* Not reported in 1910.

Capital invested	$35,072,739	$13,487,347	$21,585,392	160.0
Average per acre enterprises were capable of irrigating	$30.48	$19.52	$10.96	56.1
Estimated final cost of existing enterprises	$39,860,871	$14,754,172	$25,106,699	170.2
Average per acre included in enterprises	$23.62	$11.77	$11.85	100.7
Average cost of operation and maintenance per acre	$6.92	$3.25	$3.67	112.9
Irrigation Works				
Number of enterprises	1,371	2,772	—1,401	—50.5 †
Number of main ditches	820	861	—41	—4.8
Length of main ditches, miles	1,524	1,479	45	3.0
Capacity of main ditches, second-feet	23,261	12,818	10,443	81.5
Number of lateral ditches	2,022	832	1,190	143.0
Length of lateral ditches, miles	2,949	1,224	1,725	140.9
Number of reservoirs	368	309	59	19.1
Capacity of reservoirs, acre-feet	392,999	74,361	318,638	428.5
Number of flowing wells	135	123	12	9.8
Capacity of flowing wells, gallons per minute	62,364	37,019	23,345	68.5
Number of pumped wells	901	1,912	—1,011	—52.9

† A minus sign (—) denotes decrease.

APPENDIX G—(*Continued*)

Item	*Census of—* 1920	1910	*Increase* Amount	Per cent
Capacity of pumped wells, gallons per minute	538,565	567,126	—28,561	—5.0
Number of pumping plants	1,369	2,359	—990	—41.9
Engine capacity, horsepower	80,511	69,094	11,417	16.5
Pump capacity, gallons per minute	6,825,998	5,362,665	1,463,333	27.3
Average lift, feet	45	*	45	....

* Not reported in 1910.

APPENDIX H

Mortgage Indebtedness of Texas Farms

From the Fourteenth U. S. Census, 1920

Name of County	*Number of Farms Free of Debt*	*Having Mortgage Debt*	*Amount of Mortgage Debt*	*Value of Land and Buildings*
Anderson	1,398	515	$ 578,407	$2,049,127
Angelina	1,044	271	218,101	675,840
Archer	97	252	728,462	4,559,282
Armstrong	52	145	506,971	2,342,175
Atascosa	386	214	513,863	2,246,438
Austin	1,039	560	1,010,573	3,477,527
Bandera	194	220	338,432	1,611,506
Bastrop	832	244	462,236	1,613,659
Bee	262	218	608,633	2,018,565
Bell	819	644	2,173,473	7,461,738
Bexar	1,089	438	1,685,836	6,413,547
Blanco	222	253	699,472	2,385,199
Borden	15	94	194,706	1,057,388
Bosque	524	489	1,450,517	4,931,183
Bowie	1,393	637	728,013	2,205,815
Brazoria	661	349	468,614	1,573,275
Brazos	636	333	463,107	1,416,591
Brewster	24	97	585,078	1,609,964
Briscoe	59	120	405,976	2,744,482
Brooks	95	54	63,235	210,654
Brown	860	459	677,670	2,852,345
Burleson	631	358	630,431	1,802,231
Burnet	408	214	492,232	1,715,660
Caldwell	652	266	710,995	2,098,553
Calhoun	117	78	163,150	558,070
Callahan	457	328	1,087,635	3,532,814
Cameron	360	385	1,074,150	3,524,490
Camp	487	239	256,889	844,802
Carson	35	194	912,874	3,969,699
Cass	1,771	739	777,837	2,756,117
Castro	61	174	612,638	2,972,122

APPENDIX H—(*Continued*)

Name of County	Number of Farms Free of Debt	Having Mortgage Debt	Amount of Mortgage Debt	Value of Land and Buildings
Chambers	217	16	$ 35,525	$ 96,870
Cherokee	1,879	764	917,784	2,487,792
Childress	118	214	667,258	2,539,610
Clay	274	414	1,042,028	4,330,768
Coke	138	221	384,565	1,916,248
Coleman	409	415	866,887	3,209,794
Collin	1,041	763	2,467,602	8,816,820
Collingsworth	142	386	971,245	4,708,222
Colorado	680	466	923,695	3,406,062
Comal	356	199	754,286	2,185,465
Comanche	626	426	593,904	2,750,365
Concho	131	161	484,753	1,974,747
Cooke	578	558	1,796,441	6,924,896
Coryell	684	518	977,738	3,866,830
Cottle	105	172	633,110	2,545,164
Crosby	61	228	811,811	3,335,865
Dallam	23	94	265,110	837,669
Dallas	825	627	2,338,122	9,175,313
Dawson	39	320	719,949	3,187,974
DeWitt	808	513	1,487,911	5,580,820
Deaf Smith	57	155	568,974	2,384,535
Delta	402	219	661,925	2,583,001
Denton	736	747	2,529,079	9,392,001
Dickens	50	338	851,298	3,516,862
Dimmitt	64	60	170,320	627,110
Donley	84	270	954,531	3,979,651
Duval	283	71	194,515	997,214
Eastland	541	193	179,447	810,420
Edwards	33	131	1,253,806	4,864,302
El Paso	129	108	482,268	1,235,500
Ellis	732	668	3,242,189	12,763,976
Erath	795	595	636,186	2,685,719
Falls	743	491	1,224,891	4,168,867
Fannin	1,388	607	1,481,287	5,835,914
Fayette	1,505	926	1,837,564	5,951,648
Fisher	272	360	786,259	4,044,320

APPENDIX H—(*Continued*)

Name of County	Number of Farms: Free of Debt	Number of Farms: Having Mortgage Debt	Amount of Mortgage Debt	Value of Land and Buildings
Floyd	125	469	$1,048,135	$6,217,411
Foard	102	219	457,382	2,593,896
Fort Bend	662	288	901,414	2,503,085
Franklin	549	227	338,814	1,111,370
Freestone	808	416	497,676	1,570,195
Frio	110	138	641,499	2,312,207
Gaines	2	99	199,789	682,635
Galveston	483	65	56,832	184,525
Garza	15	262	799,787	2,480,483
Gillespie	551	425	1,146,896	4,081,100
Glasscock	14	61	25,354	131,681
Goliad	342	160	400,966	1,705,148
Gonzales	708	573	1,474,381	4,172,337
Gray	83	260	923,372	4,330,630
Grayson	1,355	752	2,541,534	9,325,255
Gregg	717	192	196,659	869,517
Grimes	894	261	337,223	1,299,926
Guadalupe	804	622	1,937,408	6,595,572
Hale	156	434	1,363,523	4,774,507
Hall	156	173	565,531	2,718,272
Hamilton	439	541	917,696	3,598,553
Hansford	29	114	370,250	2,031,210
Hardeman	158	241	635,721	3,116,212
Hardin	268	38	13,939	70,645
Harris	1,380	393	661,922	2,041,051
Harrison	1,877	420	353,499	1,132,350
Hartley	8	59	268,519	2,120,523
Haskell	229	366	782,550	3,403,532
Hays	333	212	731,035	2,161,675
Hemphill	44	144	846,936	3,658,025
Henderson	1,140	777	1,044,055	3,379,111
Hidalgo	423	640	2,375,979	8,302,304
Hill	539	873	2,979,178	12,041,167
Hood	426	199	326,056	1,217,855
Hopkins	1,482	938	1,426,903	5,248,995
Houston	1,686	451	535,441	1,550,211

APPENDIX H—(*Continued*)

Name of County	Number of Farms Free of Debt	Having Mortgage Debt	Amount of Mortgage Debt	Value of Land and Buildings
Howard	80	153	$ 347,088	$2,336,441
Hunt	1,120	720	2,333,390	8,340,482
Kleberg	39	54	106,852	402,774
Knox	171	215	523,775	2,930,580
La Salle	50	60	204,781	941,080
Lamar	1,407	600	1,162,356	4,127,498
Hutchinson	24	65	319,338	1,084,178
Irion	16	67	213,543	786,070
Jack	461	283	448,452	1,963,031
Jackson	216	251	875,655	2,513,880
Jasper	676	82	57,490	176,980
Jefferson	140	67	368,652	1,685,230
Jim Wells	98	122	589,109	1,924,421
Johnson	591	617	1,834,673	6,970,972
Jones	445	461	771,874	3,385,891
Karnes	386	368	1,015,492	2,797,648
Kaufman	727	548	1,733,061	6,288,260
Kendall	287	198	645,037	2,260,567
Kent	63	107	458,426	2,672,667
Kerr	163	218	759,447	2,658,160
Kimball	82	182	1,041,596	3,866,632
Lampasas	303	229	479,623	1,876,857
Lavaca	1,224	859	2,682,633	6,184,353
Lee	529	449	678,050	1,883,146
Leon	923	308	361,895	1,326,442
Liberty	838	75	68,597	250,680
Limestone	733	527	1,250,141	4,104,645
Lipscomb	93	200	529,885	3,183,177
Live Oak	141	130	409,169	1,318,749
Llano	254	141	706,525	3,545,115
Lubbock	165	370	1,063,192	4,258,124
Lynn	50	346	1,077,406	4,253,585
McCulloch	254	231	561,001	2,868,151
McLennan	860	723	2,649,901	8,401,216
McMullen	25	41	165,225	718,205
Madison	500	265	333,829	1,106,720

APPENDIX H—(*Continued*)

Name of County	Number of Farms Free of Debt	Number of Farms Having Mortgage Debt	Amount of Mortgage Debt	Value of Land and Buildings
Marion	601	125	$ 123,224	$ 345,065
Martin	25	63	59,973	324,005
Mason	296	193	543,241	3,232,400
Matagorda	397	185	689,331	2,604,013
Medina	417	254	727,782	3,149,761
Menard	79	98	607,261	3,165,138
Midland	23	61	453,732	2,066,525
Milam	817	564	1,168,279	3,328,680
Mills	347	320	472,637	2,926,710
Mitchell	112	118	438,544	2,456,738
Montague	908	589	731,846	2,613,344
Montgomery	630	235	208,876	678,738
Morris	437	182	240,911	798,373
Motley	73	121	301,094	1,255,905
Nacogdoches	1,511	624	643,360	2,368,298
Navarro	748	619	1,916,321	6,152,580
Newton	712	43	17,381	74,350
Nolan	153	241	259,343	1,860,101
Nueces	125	193	1,180,664	4,097,441
Ochiltree	42	140	424,215	2,671,915
Orange	186	32	61,325	227,165
Palo Pinto	289	182	234,913	1,575,934
Parker	798	544	799,408	3,051,575
Parmer	26	82	219,798	708,510
Pecos	35	110	564,696	1,807,567
Potter	24	52	199,648	1,391,220
Presidio	18	62	852,262	3,397,221
Rains	398	229	241,668	974,950
Randall	44	185	691,247	2,740,420
Real	51	111	199,422	1,542,086
Red River	1,277	518	926,282	3,006,405
Reeves	45	94	260,043	895,694
Refugio	69	35	183,738	456,742
Roberts	9	82	561,506	2,722,256
Robertson	1,011	286	408,889	2,055,100
Rusk	1,849	838	668,744	2,206,477

APPENDIX H—(*Continued*)

Name of County	Number of Farms Free of Debt	Having Mortgage Debt	Amount of Mortgage Debt	Value of Land and Buildings
Rockwall	162	120	$ 551,667	$2,640,335
Runnels	403	364	828,775	3,354,196
Sabine	613	181	95,582	299,142
San Augustine	654	196	129,086	1,081,980
San Jacinto	402	137	135,283	366,843
San Patricio	109	174	1,018,355	3,557,795
San Saba	224	355	877,938	3,570,857
Schleicher	15	130	1,025,171	3,423,171
Scurry	174	294	538,737	3,754,150
Shackelford	76	66	158,632	1,251,820
Shelby	1,574	675	554,678	2,038,103
Sherman	16	62	91,481	551,560
Smith	1,797	887	903,008	2,803,990
Somervell	40	162	250,855	701,630
Starr	422	4	3,700	42,331
Stephens	239	54	34,148	359,600
Sterling	18	61	312,703	1,300,949
Stonewall	89	156	424,345	1,798,247
Sutton	17	66	1,321,934	5,921,707
Swisher	74	229	741,556	3,558,020
Tarrant	578	596	1,549,103	6,182,711
Taylor	343	349	569,822	2,698,020
Terry	35	127	372,072	2,231,330
Throckmorton	134	137	338,931	2,179,610
Titus	752	393	591,547	2,208,975
Tom Green	176	160	634,943	2,080,315
Travis	734	346	1,055,590	4,226,110
Trinity	606	397	219,803	916,665
Tyler	572	144	87,102	280,490
Upshur	895	512	591,407	1,655,021
Uvalde	227	222	826,127	3,215,370
Val Verde	89	94	1,182,523	5,467,327
Van Zandt	1,510	971	1,518,337	4,836,635
Victoria	518	197	586,123	1,825,375
Walker	601	318	289,338	788,580
Waller	553	169	244,605	792,885

APPENDIX H—(*Continued*)

Name of County	Number of Farms Free of Debt	Number of Farms Having Mortgage Debt	Amount of Mortgage Debt	Value of Land and Buildings
Ward	36	77	$ 234,651	$ 746,825
Washington	1,084	601	1,240,591	3,583,030
Webb	69	61	228,154	1,319,004
Wharton	481	411	1,508,681	6,113,415
Wheeler	168	471	1,608,424	5,378,502
Wichita	105	83	100,128	645,530
Wilbarger	115	14	713,252	3,231,810
Williamson	886	573	2,227,041	8,356,102
Wilson	627	389	925,724	3,674,904
Wise	604	565	1,166,770	4,573,548
Wood	1,227	740	831,803	2,776,963
Yoakum	2	70	218,699	775,985
Young	400	362	699,184	3,576,650
Zapata	180	5	3,700	19,757
Zavalla	60	68	248,421	1,341,795

There were 105,490 farms reported to the census enumerators as free from mortgage debt and 69,490 mortgaged farms. There were 25,780 farm owners who failed to report whether debt free or mortgaged. The total mortgage debt as reported amounted to $172,166,818. This was an average of $2,477.57 on each mortgaged farm. The average value per farm, including land and buildings, was $8,486.

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